

PROCEEDINGS

ABSTRACTS OF PAPERS, 83rd Annual Meeting of the Virginia Academy of Science, May 17-20, 2005, James Madison University, Harrisonburg, Virginia

Aeronautical and Aerospace Sciences

SOME EVENTS IN THE HISTORY OF AVIATION – FROM THE EARLY DAYS OF MANNED, POWERED FLIGHT TO SPACE ACCESS. M. Leroy Spearman, NASA-Langley Research Center, Hampton, VA 23681 & Jill Harper, GWU, King George, VA 22485. Since the advent of manned, powered flight in 1903, there has been remarkable growth in the field of aviation. Initially, the United States was slow to adopt to the use of aircraft whereas significant progress was being made in European countries. With Europe on the brink of World War I, the use of aircraft was seen as a vital part of warfare. In an effort to advance the knowledge of aeronautics, the United States Senate passed legislation that created the National Advisory Committee for Aeronautics (NACA). With wind tunnels constructed at Langley Field, VA, aeronautical research was underway in the early 1920's. In addition to the potential value in warfare, aircraft were seen as a valuable asset for civil purposes as well. Through the application of advanced research, aircraft design and the capability of aircraft has improved. A significant improvement in capability was realized with the development of the jet engine as a power source other than the traditional propeller propulsion system. The increase in speed and efficiency were to enhance the utility of aircraft for both military and civilian use. The increase in speed capability has made it possible to access space and research continues in the development of vehicles to be used in space exploration.

CONCEPTS FOR TRANSATMOSPHERIC VEHICLES. M. Leroy Spearman, NASA-Langley Research Center, Hampton, VA 23681 & Jill Harper, GWU, King George, VA 22485. The thrust required to propel a vehicle out of the atmosphere is available with rocket propulsion. The North American X-15 research airplane demonstrated early examples of this capability. The X-15 was designed to demonstrate hypersonic speed capability and was not intended for space flight. While the X-15 did achieve hypersonic speed, the range for the aircraft was quite limited and not sufficient for any meaningful hypersonic cruise mission. Possible missions to exploit hypersonic capability could be for what is referred to as a transatmospheric vehicle (TAV). Such a vehicle would be able to exit the atmosphere, maintain orbital flight, reenter the atmosphere to perform special missions, be able to return to orbital flight, or to return for an earth landing. Extensive research has been conducted on a variety of such vehicles. These have included what is known as lifting-body designs in which large bodies having the required volume are shaped so as to provide lift. In other cases, bodies have been equipped with various forms of shape changing such as retractable wings or morphing components. While no TAV has yet been produced, the aerodynamic research for such a concept is in hand. In addition, recent advances in propulsion such as the scramjet engine would enhance the development of a TAV.

SOME CONCEPTS FOR LARGE LOGISTIC AIRLIFT VEHICLES. M. Leroy Spearman, NASA-Langley Research Center, Hampton, VA 23681 & Jill Harper, GWU, King George, VA 22485. Aircraft are vital in the logistic support of manpower, supplies and equipment in the event of warfare. Such support may be required rapidly and to locations at great distances from the homeland. Conventional aircraft can provide the need for speed but the load capacity is limited. Ocean-going vessels can provide large load-carrying capability but the speed is limited. In an effort to combine the need for capacity and speed, some research with an unconventional design has been done. The design has a large rectangular wing surface mounted inboard of large bodies attached to each wing tip. The use of two bodies of a conventional aircraft design results in doubling the capacity of the conventional aircraft. The large area for the rectangular wing provides adequate lift to sustain flight. In addition, it was found that the wing, when positioned near the surface, could provide a cushion of air that would permit operation as a wing-in-ground (WIG) effect vehicle. Another possibility

considered was the use of a portion of the bodies as containers for helium gas that would permit operation as a hybrid airship with vertical take-off and landing (VTOL) capability. Thus, the inboard wing arrangement potentially provides for large load carrying capability with a vehicle that could operate in free-air as an airplane, or in a WIG mode, or with a VTOL capability.

Agriculture, Forestry and Aquaculture Science

DETERMINING THE INFLUENCE OF RIPARIAN BUFFER WIDTH ON THE BENTHIC COMMUNITY STRUCTURE OF HEADWATER STREAMS IN THE SOUTHERN APPALACHIANS. Eric R. Sokol & E. F. Benfield. Department of Biological Sciences, Va. Polytechnic Inst. & State Univ., Blacksburg, VA, 24061. Strong relationships have been demonstrated between catchment-wide logging practices and the benthic community structure in headwater streams. We hypothesize a hierarchical model will apply where catchment scale terrestrial disturbance modifies a suite of in-stream factors (endogenous variables) that influence benthic macroinvertebrate community structure (response variable) in patterns that may be observable at smaller scales (e.g., reach, bedform, or substrate). Multivariate techniques, such as Structural Equation Modelilng (SEM), provide methods to explore the relationships among endogenous variables responsible for linking catchment scale disturbances to smaller scale in-stream responses that may be influenced by riparian buffer width. SEM analysis of data pooled from previous studies suggests there are significant hierarchical interactions among environmental variables (e.g., watershed area, temperature regime, and flood regime) used to predict benthic macroinvertebrate community structure.

SAMPLE SIZE REQUIREMENT FOR WATER QUALITY ANALYSIS IN HYBRID STRIPED BASS PONDS. Brian L. Nerrie. Cooperative Extension. Virginia State University, Petersburg, VA 23806. Hybrid striped bass (*Morone chrysops* x *M. saxatilis*) demonstration ponds have been established at several locations in Virginia to promote the expansion of hybrid bass aquaculture. These ponds vary in surface area and average depth. Demonstration ponds at Virginia State University have an area of 0.05 hectare and average depth of 100 cm. Cooperating farmers' larger ponds range from 4-10 hectare and average depth of 200 cm. Sampling stations were established to collect pond water quality data. Parameters important for hybrid culture include dissolved oxygen concentration, water temperature, secchi disk visibility, and total hardness. Single sampling stations were used for smaller pond due to uniform water mixing by aerators. Multiple stations (5) were established in April, 2005 at larger ponds to evaluate the influence of phytoplankton density, wind currents, and water exchange. Means and variances were determined for sampled measurements and the required sample size calculated to ensure 95% certainty that errors will not exceeding expected level. Lack of variances suggests only one sample required for large ponds. Supported by: USDA Sunshine Bass Project. Lead Institution: Kentucky State University, Sub-contract - Virginia State University

PESTICIDE DISCOVERY: SCREENING *EUONYMUS AMERICANA* L. SEED COATEXTRACTS AND FRACTIONS TO CONTROL WHITEFLY. F. Favi and M. Kraemer, Agricultural Research Station, Virginia State University, Petersburg, Virginia. Lethality of crude methylene chloride and ethyl alcohol extracts and their fractions (1-11) were tested on adult whiteflies. Methylene chloride extract fraction number three is significantly ($F = \text{infinity}$, $DF = 9$ and $p < 0.0001$) the best of all five (numbered 1-5) fractions to kill adult whiteflies in 45 min. Crude ethyl alcohol extract is significantly more potent than any of its six fractions (numbered 6-11) ($F = \text{infinity}$, $DF = 9$ and $p < 0.0001$) to kill them in 30 min. Mixture of fractions 11 & 9 kill 79.7% and is more potent than individual fraction (# 9, 55.7%; # 11, 75%) to control whitefly population. Synergic effect was observed when mixture of fractions 9 & 11 was applied. Fraction number nine prevents adult whiteflies from settling down and feeding whereas fraction number eleven made them defecate profusely. Such effects were also observed in human during clinical trial conducted early this century.

EFFECTIVE USE OF NATURAL ENEMIES FOR PEST CONTROL IN VIRGINIA TOMATO GREENHOUSES. M. Kraemer and F. Favi, Agricultural Research Station, Virginia State University, Petersburg, Virginia. Pesticide-free production of greenhouse tomatoes requires the use of natural enemies to control pest populations. Regular introductions of natural enemies can be expensive. We evaluated the effect of several natural enemies on pest populations of fungus gnats and thrips over a 4-year period in one greenhouse in southern Virginia. Beneficial nematodes were often effective in control of fungus gnats but had to be introduced in larger numbers than recommended by suppliers. Nematodes did not reproduce and needed to be re-introduced regularly. However, the initial introduction at transplanting is not needed because suitable host stages are not available. Predatory spider mites in sachet bags were effective but required several weeks head start before the spring invasions of thrips from outside. Rove beetles appear to be an excellent predator for both thrips pupae and fungus gnat larvae, and will reproduce in the greenhouse environment.

WATER QUALITY PARAMETERS FROM AN EXPERIMENTAL GRAVEL BED AQUAPONIC SYSTEM. David Crosby, Brian R. Roosa and Chris Mullins, Cooperative Extension, PO Box 9081, VSU, Petersburg, VA 23806. An experimental aquaponic system was setup in greenhouse for testing its potential production capabilities for the fish and plants. The system used a 4 ft x 8 ft gravel bed as the biofilter for a 150 gallon fish tank and as the plant media. The system was flooded for a three-minute duration every fifteen minutes. Basil was grown in the gravel beds as the hydroponic part of the study. Water quality parameters: TAN, pH, nitrite, alkalinity, and hardness were monitored daily. Thirty tilapia were stocked at 90 grams each. Fish gained an average of 25 grams each in 55 days and resulted in a 2.1 FC. Nitrite levels peaked first at 11.9 ppm within six days of the study and TAN peaked at 14 ppm within 12 days. TAN dropped to acceptable levels within eight day after peaking to 1.5-1.9 ppm for the remaining duration of study. Hardness showed a steady increase and peaked in 14 days into study at 155 ppm of hardness and dropped to 34.2 ppm for the rest of the study. Plant analyses were done twice during the study for the Basil. All test parameters for Basil felled within normal ranges. This experimental gravel bed aquaponic system would be useful to small family farms seeking alternate production methods for crop diversification.

CATFISH FINGERLING PRODUCTION USING TWO STOCKING DENSITIES. David Crosby, Brian R. Roosa and Scott H. Newton, Cooperative Extension, PO Box 9081, VSU, Petersburg, VA 23806. Producing catfish to compete with the southern catfish industry is a challenge for Virginia's aquaculture. Virginia's aquaculture industry needs a 6-inch fish in one growing season. Since spawning catfish in Virginia is 1-½ months behind the southern catfish, producing a 6-inch catfish in one growing season is a challenging task. Four ponds were stocked with catfish fry at 20,000 fish per acre and 40,000 fish per acre on June 23 and July 1, 2004. All fish were fed daily. The ponds with 40,000 fry were sampled in September 2004 with an average mean ranging from 12.1 cm to 12.5 cm while ponds with the 20,000 fry ranged from 12.3 cm to 12.8 cm. When fry ponds were harvested in March 2005, unexpected mortalities were found. Nearly all fry ponds had no fish. The surviving fish were heavily parasitized with of Ich and Trichodina. This may have caused slow and chronic mortalities during the winter. With a large resident winter gull population at the ponds, all mortalities would have been consumed leaving no indication that a wintertime epizootic had occurred. Out of the eight ponds used in the study, only about 1600 fish survived. The data on the survivals indicated the 6 to 7 inch fingerlings are possible during one growing season.

EFFECTS OF INTRACEREBROVENTRICULAR ADMINISTRATION OF ENTEROSTATIN ON FEED AND WATER INTAKE IN CHICKS (*GALLUS GALLUS*). Catherine A. Twimasi & Mark A. Cline, Neurophysiology and Behavior Lab, Dept. of Biol., Radford Univ., Radford, VA 24142. Enterostatin, a protein chiefly expressed by the pancreas in response to duodenal filling, is a satiety signal. The effects of centrally administered enterostatin in mammals are documented; however no information is available for avian species. Thus, we conducted an experiment to determine the effect on appetite after central administration of enterostatin in chicks (*Gallus gallus*). Chicks were

assigned to randomly receive 0.0, 0.5, 1.0, 2.0 micrograms of human enterostatin dissolved in artificial cerebrospinal fluid and injected intracerebroventricularly. Feed and water intake were monitored post treatment. Enterostatin had no effect on feed or water intake. Our results did not correspond to previous studies conducted in sheep and rats. We conclude that central administration of human enterostatin at the doses tested here has no effect on ingestive behavior in chicks. We plan to repeat this experiment using different doses of enterostatin.

EFFECT OF INTRACEREBROVENTRICULAR ADMINISTRATION OF AMYLIN ON FEED AND WATER INTAKE IN 4-DAY POST HATCH CHICKS. Wint Nandar & Mark Cline, Neurophysiology & Behavior Lab, Dept. of Biol., Radford Univ., Radford, VA 24142. Amylin, a 37-amino acid peptide, is produced in gastrointestinal mucosa, and in the central nervous system. Studies in rats demonstrated that amylin participates in regulation of glucose homeostasis and decreasing insulin secretion. Amylin also inhibits feed intake, decreases body weight by reducing meal size, increases post meal interval of satiety, decreases gastric emptying and increases thirst in rodents. The biological role of amylin in avian is unclear. Thus, we conducted an experiment to determine the effects of amylin on feed and water intake in chickens. Four-day old *Gallus gallus* chicks randomly received intracerebral injection of either 0.0, 0.5, 1.0 or 2.0 µg rat amylin, and feed and water intake were monitored for 90 minutes post injection. Chicks that received 0.5 µg of rat amylin had an increase, while chicks that received 1.0 or 2.0 µg amylin had a decrease in feed intake. Thirst was not affected by treatment. This is the first report that demonstrates a feed inducing role for amylin in any species. Apparently, amylin modulation of appetite differs between rats and avian.

EFFECT OF INTRACEREBROVENTRICULARLY DELIVERED ENTEROSTATIN ON FEED INTAKE IN GOLDFISH. Marissa L. Smith & Mark A. Cline, Neurophysiology and Behavior Laboratory, Radford University, Radford, VA 24142. Enterostatin, also known as colipase activation peptide, is a 5 residue peptide formed during tryptic activation of pancreatic procolipase. It has been demonstrated to reduce feed intake in mammals, however effects in fish are unknown. Thus, goldfish were intracerebroventricularly administered with 0, 1, 10, or 100 µg human Enterostatin dissolved in teleost saline using a freehand method. Fish were then returned to their individual tanks and given 15 min to recover from the injection procedure prior to being fed a predetermined quantity of sinking feed pellets. The bottom of the tanks were photographed every 15 min post feeding for a total of 120 min. The number of feed pellets was quantified at each time interval. Enterostatin caused a dose-dependant linear decrease in cumulative feed intake at all observation times. These results are similar to those found in mammalian species. Based on these results, Enterostatin antagonists are a logical target to increase body weight in fish.

DISTRIBUTION AND RELATIVE ABUNDANCE OF NUTRIENT TRANSPORTERS IN THE GASTROINTESTINAL TRACT OF BLACK BEARS. E. Gilbert¹, E. Wong¹, M. Vaughan², & K. E. Webb, Jr.¹. ¹Department of Animal and Poultry Sciences, VT, Blacksburg VA 24061 and ²Department of Fisheries and Wildlife, VT, Blacksburg VA 24061. Distribution and abundance of mRNA of a peptide transporter (PepT1), a glucose transporter (SGLT1), two amino acid transporters (NBAT, b⁰⁺AT), and a digestive enzyme, aminopeptidase N (APN) was investigated in the gastrointestinal tract of black bears. Intestine was removed from 10 bears and divided into five sections, and each section was opened longitudinally and the mucosal scrapings were stored at -80 °C. Total RNA was extracted and quantified by spectrophotometry. Abundance of PepT1, SGLT1, NBAT, b⁰⁺AT, and APN mRNA was determined by performing northern blots, using bear cDNA probes. Abundance of PepT1 ($P < 0.05$), APN ($P < 0.05$), and SGLT1 ($P < 0.0001$) changed quadratically from the proximal to distal intestine. Abundance of b⁰⁺AT mRNA increased linearly ($P < 0.05$) from intestinal segment 1 to intestinal segment 5. Abundance of NBAT mRNA did not

change between intestinal segments. Our results indicate that the nutrient transporters examined and APN are differentially distributed throughout the gastrointestinal tract of black bears, indicating their involvement in nutrient assimilation.

IMPROVING CHANNEL CATFISH PROCESSING AND YIELD CAPACITY BY MANIPULATING HARVESTING AND GRADING TECHNIQUES. Albert O. Reid, Virginia State University. Small scale producers are reluctant to invest enormous amounts of capital on seasonal and infrequently used fish processing equipment. These producers usually process fish by hand using various parochial techniques resulting in irregularly shaped and wasteful fillets (less than 27%). Four state of the art fish processing machines located at VSU's Randolph Farm have empowered small producers with a means by which to process their fish. Greater fish fillet yields (greater than 27%) and uniformity of products correlate to maximum profits. The key to increased fillet yield is directly related to harvesting the appropriate size fish. It was found that by selecting fish within 2.5 and .75 pounds significantly improved fillet yield at this processing facility. Grading fish in the pond was found to be the most appropriate method. This can be achieved by using grading bars or fish measuring boards at the pond site. Properly graded fish has the potential to double the output at this facility.

NUTRIGENOMICS: A PREVIEW OF FUTURE NUTRITION. Ali Mohamed, Dept of Biology, Virginia State University, Petersburg, VA 23806. Discoveries associated with sequencing the human genome and the development of related technologies have paved the way for an unparalleled understanding of the molecular functioning of organisms that ultimately will transform nutritional practice. The interface between the nutritional environment and cellular/genetic processes is being referred to as "nutrigenomics." Nutrigenomics seeks to provide a molecular genetic understanding for how common dietary chemicals (i.e., nutrition) affect health by altering the expression and/or structure of an individual's genetic makeup. This new era of molecular nutrition can unfold in dichotomous directions. The first direction focuses on the effects of nutrients or food bioactives on the regulation of gene expression (ie, nutrigenomics). The second is determining the impact of variations in gene structure on one's response to nutrients or food bioactives (ie, nutrigenetics). The challenge of nutritionist will be to balance the needs of the community with those of the individual. In this regard, the excitement and promise of molecular nutrition should be tempered by the need to validate the scientific data emerging from the disciplines of nutrigenomics and nutrigenetics and the need to educate practitioners and communicate the value to consumers—and to do it all within a socially responsible bioethical framework.

Astronomy, Mathematics and Physics (with Materials Science)

LASER-INDUCED FLUORESCENCE FOR CANCER DIAGNOSIS. Matthew Musgrave, Dept. of Physics, James Madison Univ., Harrisonburg, VA 22807. Esophageal cancer is one of the most deadly forms of cancer, and currently the most reliable way to diagnose esophageal cancer is by biopsy. A biopsy involves sending an endoscope down the patient's throat and cutting a piece of tissue out; then the sample must be analyzed, which could take several days. A new procedure is being developed at Oak Ridge National Laboratories to detect esophageal cancer that utilizes laser-induced fluorescence for *in vivo* cancer diagnosis. During the procedure a laser is sent down the biopsy channel of an endoscope and excites the tissue at five different wavelengths (400 nm, 420 nm, 440 nm, 460 nm, 480 nm). The intensity of the fluorescence is measured over a broad range of wavelengths, normalized with respect to the total intensity measured, and graphed. The fluorescence signal for normal tissue is different than the signal for cancerous tissue. So by measuring how much the normalized data collected from a region of esophageal tissue differs from the spectrum of a standard normal graph, it can be determined whether or not the tissue is cancerous. The results

collected so far using this technique are in agreement with the classifications made by a biopsy procedure. This technique has the potential to be a quick, cost-effective method to diagnose cancer.

CIRCUITS FOR DTECH LABS. Joel C Bodine. Dept. of Physics, James Madison University, Harrisonburg Virginia, 22801. Technology is always advancing. People today use these magical objects without even a thought about how they were made or how they came about. DTech Labs is one of those companies that design and build these types of products. DTech Labs is a private contractor for the DOD, NSA, military and other companies. They provide products and services that will make the customers jobs easier and more secure (mostly electrical engineering). Many of DTech Labs products deal with homeland security and secure wireless communication. My Talk today will be about one of the projects that I was fortunate enough to participate with. In particular, a circuit board that can be used as an alarm that sends a message to a receiver within a short range. The circuit board that we have built can have many uses with simple modification, which, will be described in the talk.

THE EFFECT OF BACKGROUNDS ON THE MEASUREMENT OF THE LIFETIME OF THE MUON. Rebekah Esmaili, Physics Dept., James Madison Univ. The Fermi coupling constant is determined using the lifetime of the positive muon. The MULAN collaboration is currently measuring the positive muon lifetime to 1 ppm. To achieve a 1ppm lifetime measurement at least 1×10^{12} muon decays need to be recorded. Also a highly systematic free experiment has to be performed. The final system will use state of the art digitization techniques to provide time and energy information for each decay. This paper will focus on the relationship between the various types of events detected and their influence on the lifetime. For example, cosmic rays are detected and accumulated along with muon decays. These events are completely uncorrelated and therefore contribute to the flat background, which doesn't strongly influence the measurement. Dead time in any detector, on the other hand, can create a time dependent efficiency that can strongly bias the measurement and will require modularity and careful monitoring. These and other backgrounds will be described.

EXTRACTION OF DOCUMENTS FROM PLASTIC LAMINATES. James H. Martin. School of Mathematics and Science, J. Sargeant Reynolds Community College, Richmond, VA. Prior to the 1980's, plastic lamination was the suggested method for preservation of many documents. It has been found that the plastic lamination deteriorates and often damages the document, so it has become necessary to remove the laminates without damaging the encapsulated document. Cellulose acetate laminated (Barrow method) documents can be extracted by an acetone bath which dissolves the cellulose acetate. Documents sealed between two self-adhesive plastic sheets often become transparent and although the plastic laminate comes in many types, chloroform will generally dissolve the adhesive, freeing the document which can then be washed with appropriate solvents such as acetone or petroleum ether. Modern heat sealed laminates are currently being studied, but, no method has yet been found which does not cause some detectable damage the document.

NEAR INFRARED EMISSION FROM Dy^{3+} AND Nd^{3+} DOPED POTASSIUM LEAD HALIDES. J. A. Freeman¹, U. Hömmerich¹, E. Nyein¹ & S. B. Trivedi², ¹Hampton Univ., Hampton, VA and ²Brimrose Corp. of America, Baltimore, MD. The purpose of this research is to find new infrared (IR) emitting materials that show promising characteristics for operating within the optical communication windows. Dysprosium and Neodymium doped Potassium Lead Halides are considered to be promising candidates for optical amplification of 1300 nm and 1500 nm signals used by telecommunication networks. Chlorides and Bromides are being considered as new host materials for rare earth (RE) ions because they can produce efficient IR emission. Based on the energy gap law, the probability for multiphonon non-radiative decay is reduced in host materials with small phonon energies. Halide crystals with phonon energies between 200-300 cm^{-1} are ideal candidates for efficient emission from RE ions. We are currently evaluating Dy^{3+} and Nd^{3+} doped Potassium Lead Bromide (KPb_2Br_5 , KPB) for application as an efficient infrared emitter. The Dy and

Nd doped KPB crystals were synthesized at Hampton Univ. For comparison, Dy doped KPb_2Cl_5 (KPC) was also prepared. Dy:KPB, Dy:KPC, and Nd:KPB showed emission bands in the windows of 1300 nm and 1540 nm under 808 laser pumping. Compared to Dy: KPC, Dy: KPB exhibited a significantly stronger 1540 nm emission.

MULTIJUNCTION THERMOELECTRIC HEAT SENSORS. David J. Lawrence¹, John A. Gotwald¹ & Gerald R. Taylor, Jr.², ¹ISAT Department, ²Physics Department & ^{1,2}Center for Materials Science, James Madison University, Harrisonburg, VA 22807. Thermocouples are widely used for temperature measurement and other thermal sensing tasks. A thermopile, consisting of series-connected thermocouples, provides a greater output voltage than a single thermocouple junction. This enhanced sensitivity makes thermopiles particularly useful when small temperature changes must be measured. Microfabricated thermopiles have the additional advantages of ruggedness and compact size, and they may serve as the basis of chemical sensors and biosensors capable of detecting selected antigens. We describe the microfabrication and characterization of thermopiles having up to 36 antimony-bismuth sensing junctions. The antimony and bismuth thin films are deposited by thermal evaporation and they are patterned using photolithographic techniques. The thermopiles are fabricated on polyimide membranes supported by silicon wafers or thin aluminum plates. The sensing regions of these devices have a low thermal mass because the sensing junctions are fabricated on a polyimide “drumhead”. The best devices have a sensitivity of approximately 4 mV/°C and heating and cooling time constants of approximately 1.1 s.

ANALYSIS OF ELECTRO-OSMOTIC MOBILITY IN MICROFLUIDIC CHANNELS MEASURED BY THE CURRENT MONITORING METHOD. W. Christopher Hughes¹, Brian H. Augustine², & Antoinette C. Bonhivert², ¹Department of Physics, James Madison University, Harrisonburg, VA 22807 & ²Department of Chemistry, James Madison University, Harrisonburg VA 22807. Microfluidic structures are being exploited in many new novel devices because of the ability to move solutions through them using electro-osmotic flow (EOF). Any proposal to use materials other than glass for these devices will depend on a thorough understanding of the EOF arising from the charged surfaces of these materials. The existing standard method for measuring the EOF mobility, the proportionality between an applied electric field and the velocity of the flowing solution, is the so-called current monitoring technique. This technique involves measuring the time that it takes for the resistance of a micro-channel to completely change as a solution of one concentration replaces another. A flaw in this method is the imprecision in determining the start and end times of the current change. We propose a new method in which the time rate of change of the reciprocal of the current is proportional to the EOF mobility. Since this technique involves the determination of a linear slope, it is inherently more precise. We have demonstrated this derivative technique with both glass and acrylic chips.

INEXPENSIVE USB LABORATORY INTERFACES. Joseph W. Rudmin, Dept. of Physics, James Madison Univ., Harrisonburg, VA 22807. Problems of interfacing laboratory experiments to Windows-based personal computers will be discussed. A recent development is the marketing of modular interfaces which connect to the computer via the Universal Serial Bus or USB port. Capabilities, limitations, supporting software, and possible applications will be presented. A typical interface, the Minilab 1008, produced by Measurement Computing Company, which includes a counter, 18 digital programmable I/O lines, 8 channels of 12-bit analog input, and 2 channels of 12-bit analog output, will be demonstrated.

Biology

A GENETIC STUDY OF ANTI-OXIDANT FACTORS IN YEAST. Kimberly Slekar, Amy Turner & Kristin Ditzler, Department of Biology, James Madison University. Harrisonburg VA 22807.

Oxygen presents a paradox to aerobic organisms because it is essential for life, while toxic at the same time. Reactive molecules of oxygen are constantly formed in cells of aerobic organisms, from bacteria to humans. These reactive oxygen molecules damage critical cell components if left unchecked, a phenomenon called "oxidative stress". Aerobic organisms have evolved with enzymes to combat oxidative stress, including glucose 6-phosphate dehydrogenase (G6PD), which generates NADPH via the pentose phosphate pathway. We used *Saccharomyces cerevisiae* as a model system to investigate genes that are functionally related to the gene that encodes G6PD in yeast, *ZWF1*. We took a genetic approach by studying both mutational (*pho85*) and multi-copy (*ZMS1*, *ZMS2*) suppressors of a yeast *zwf1* mutation, and investigated whether the suppressors act through the same or separate pathways to suppress *zwf1*. This work enables a better understanding of the functional interaction between different anti-oxidant factors, using the simple eukaryotic model system provided by baker's yeast.

THE JACALIN-RELATED LECTIN (JRL) DOMAIN OF MAIZE β -GLUCOSIDASE AGGREGATING FACTOR (BGAF) IS INVOLVED IN β -GLUCOSIDASE BINDING. Mallikarjun D. Lalgondar¹, Farooqahmed S. Kittur¹, David J. Blanchard², David R. Bevan³ & Asim Esen¹, ¹Dept. of Biological Sciences, Virginia Tech, ²U.S. Patent and Trademark Office, Alexandria, VA and ³Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061. β -Glucosidases (β -D-glucoside glucosylhydrolase, EC 3.2.1.21) catalyze the hydrolysis of aryl and alkyl β -glucosides as well as β -linked oligosaccharides. Certain maize lines were reported to lack β -glucosidase (Glu) activity based on zymogram data. It has been shown that these lines have enzyme activity, but the enzyme is not extractable because a 32 kD protein (referred to as BGAF or β -glucosidase aggregating factor) specifically interacts with Glu during extraction, rendering the enzyme insoluble or poorly soluble. BGAF is a chimeric protein consisting of two distinct domains: the disease response (also known as "dirigent") domain and the jacalin-related lectin (JRL) domain. To understand which domain interacts with Glu, we cloned the Dirigent and JRL domain encoding regions of the *bgaf* cDNA separately and expressed them in *E. coli*. β -Glucosidase aggregation assay showed that the JRL domain interacts with Glu. (Supported by The Virginia Academy of Science and NSF).

PRELIMINARY STUDY ON GENE TRANSFER IN FUNGI (REISHI, SHITAKE, C-OYSTER) BY ELECTROPORATION. Witemba Kabange & Fang Sheng Wu, Dept. of Biol., Va. Commonwealth Univ., Richmond, VA 23284. Genetic transformation involves transferring genes both within species and between species to obtain a desired trait; this differs from the mixing of genes through sexual reproduction. In contrast to prokaryotic organisms, eukaryotic organisms cannot easily pick up a gene, incorporate it in their genome and replicate it. Therefore, new techniques are needed to improve the insertion of genes into eukaryotic organisms. This experiment was performed to test the efficiency of transforming mushroom by electroporation. Approximately 2-8 mm of gill tissue with intact veil were taken from *Reishi*, *Shitake* and *C-oyster* mushrooms and grown on potato dextrose agar (PDA) supplemented medium. After approximately 2 weeks in culture, mycelia growing on PDA medium were transferred into 24 well plates, rinsed twice with dH₂O, shocked for 10 minutes between the rinses, vacuum infiltrated for 5 minutes and electroporated with plasmids containing one of three hygromycin resistance genes (PD4, PLG or P49) at 25 °C and between 1.2-1.7 kv. Mycelia were then grown on a hygromycin-enriched malt extract medium. Mycelia containing the plasmid grew profusely while mycelia without hygromycin-resistance genes showed very little to no growth.

EFFECTS OF THE LOCATION OF SUBCUTANEOUS INJECTIONS OF LIPOPOLYSACCHARIDE ON THE FREQUENCY OF PREGNANCY LOSS IN CD-1 MICE. Sushma Shrestha¹, Carolyn M. Conway² & Arthur F. Conway¹, ¹Dept. of Biology, Randolph-Macon Coll., Ashland, VA 23005 and ²Dept. of Biology, Virginia Commonwealth Univ., Richmond, VA 23284. Lipopolysaccharides (LPS) cause strong inflammatory responses and can cause pregnancy loss at low doses in mice. Previous studies indicated that frequency of pregnancy loss in response

to subcutaneous injection of lipopolysaccharide (LPS) varied in response to the location of the injection. We subcutaneously injected pregnant female CD-1 mice in the tail base, flank, or neck region with 0, 2, or 5 g of LPS on day nine of pregnancy and evaluated pregnancy loss on day twelve. Frequency of pregnancy loss, maternal body weight loss, and maternal spleen weight gain were all significantly altered in a dose sensitive fashion by LPS injection. The location of the injection had no significant effect on any of the parameters measured. The lack of a clear relationship between frequency of pregnancy loss and the distance of the LPS injection from the reproductive tract argued strongly against pregnancy loss depending upon mechanisms such as inflammatory cytokines acting locally through tissue fluid or lymphatic drainages.

EFFECTS OF POLYCHLORINATED BIPHENYLS ON THYROID FUNCTION OF JAPANESE QUAIL. Catherine M. Webb & F. M. Anne McNabb, Dept. of Biol. Sci., Virginia Tech, Blacksburg VA 24061. Chemical contaminants, including polychlorinated biphenyls (PCBs), have been associated with detrimental effects on wildlife in several regions of the Great Lakes. These effects include altered thyroid gland function, which may result in hypothyroidism. PCBs cause hypothyroidism in mammals by two mechanisms which facilitate T_4 excretion: (1) induction of uridine diphosphate-glucuronosyltransferase (UDP-GT), a liver enzyme that glucuronidates thyroxine (T_4); and (2) displacement of T_4 from transthyretin, a thyroid hormone-binding plasma protein. Induction of mammalian UDP-GT by PCBs has been studied extensively in mammals, but there is little research in this area on birds. We developed and validated an assay using labeled T_4 as substrate for measuring avian UDP-GT activity and determined the effects of Aroclor 1254, a mixture of PCB congeners, on UDP-GT activity and thyroid function in weanling mice and Japanese quail chicks. We found that PCBs linearly and significantly induced UDP-GT activity and decreased plasma T_4 in both quail and mice. Quail had lower enzyme activity, less enzyme induction, and a smaller decrease in plasma T_4 than mice. Supported by a Virginia Tech Graduate Research Development Project grant.

EFFECTS OF THYROID DISRUPTION ON GENE EXPRESSION IN DEVELOPING AVIAN BRAIN. Yu Chen, Dept. of Biological Sciences, Virginia Tech., Blacksburg VA 24061. Thyroid hormones (THs) are essential for normal brain development and regulate the expression of TH-responsive genes in the brain at specific developmental periods. Exposure to environmental contaminant forms of polychlorinated biphenyls (PCBs) leads to hypothyroidism in laboratory rats. Some evidence indicates that PCB exposure may alter thyroid function in birds. I hypothesize that PCB-induced hypothyroidism will be associated with altered expression of thyroid-regulated genes in developing avian brains. The hypothesis is being tested by studying the expression of the thyroid regulated RC3 gene in the brain of developing Japanese quail exposed to PCBs. RC3 codes for a neuron-specific calmodulin-binding protein involved in regulating neuronal Ca^{2+} dynamics. An increase in RC3 mRNA and protein level coincides with the onset of synaptogenesis in the developing brain. Hypothyroidism lowers the RC3 mRNA level in both developing and adult mammals and has an adverse effect on the central nervous system. Japanese quail RC3 mRNA has been separated and sequenced from embryonic brain total RNA. RC3 mRNA level in both normal and PCB exposed embryonic brains will be analyzed by Northern blot.

TEMPERATE-ZONE SMALL MAMMALS: AN EXAMINATION OF THE HISPID COTTON RAT IN SOUTHEASTERN VIRGINIA. Heather A. Green & Robert K. Rose, Dept. of Biol., Old Dominion Univ., Norfolk, VA. 23529-0047. Seasonal variation observed in temperate-zone climates demonstrates unique challenges to the animal species that inhabit them. Winter is by far the most difficult season for most animals. Small mammals, due to their relative size, are subject to additional environmental pressures and are limited in their ability to cope during the winter months. An examination of the hispid cotton rat in southeastern Virginia, which is a typical temperate-zone small mammal, will serve to demonstrate how this species has adapted to survive at its most northerly

location on the east coast, especially during the winter months. Previous studies have provided evidence of negative growth of males and females over the winter months. A determination of the rates of growth in males and females throughout the seasons in Virginia will serve to confirm these findings, as well as provide a basis for comparison with those of other geographic populations. By comparing growth rates within each season in Virginian populations, patterns should emerge demonstrating higher and lower rates of survival during different times of the year. Newly collected data associated with winter growth rates may also reveal new insight concerning winter survivorship of cotton rats.

STOMACH WORM INFESTATIONS IN METAPOPOPULATIONS OF COTTON RATS. Kelly Proctor & Robert K. Rose, Department of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529-0266. Virginia is the northernmost limits of cotton rat (*Sigmodon hispidus*) distribution on the east coast. Thus, these animals have potential difficulties, especially during winter. Cotton rats are host to numerous parasites, including large round worms of two genera that reside in the stomach. These stomach worms have indirect life cycles for which arthropods are the intermediate hosts. Consumption of the arthropods enables the stomach worms to complete their life cycle, and eggs are discharged in the feces of cotton rats. Previous studies of necropsied cotton rats in eastern Virginia have revealed that unmowed oldfields supported cotton rat populations with high infestation rates (70-80%) of stomach worms and no seasonal variation in infestation rates, whereas frequently mowed sites had lower levels of parasitism (20-30%) but showed seasonal variation. One goal of our study is to learn whether rates of parasitism can be learned by examining eggs of stomach worms in cotton rat feces rather than relying solely on necropsy methods. Another goal is to examine metapopulations within a region, and to test the hypothesis that rates of infestation are related to the age of oldfield habitats and season.

A DIETARY STUDY OF *SIGMODON HISPIDUS*, THE HISPID COTTON RAT, IN SOUTHEASTERN VIRGINIA. S. Matthew Wicks & Robert K. Rose, Biol. Department, Old Dominion Univ. Norfolk, Va. 23508. The purpose of this study is to investigate the diet of the cotton rat, *Sigmodon hispidus*, in Chesapeake, Virginia. This analysis will be accomplished by collecting fecal samples from animals that are live trapped from a field site owned by the Nature Conservancy. Fecal analysis will be completed with a method devised by Stewart, which involves clearing 1 g samples and then examining them with the use of a light microscope at 400x magnification. Reference slides will be created using samples of epidermis of plants collected from the study site, and will be used to identify the species of plants and their frequency found in the fecal samples. Insects will also be collected to enable their identification to order and family in fecal samples as well. This study will complement similar studies conducted in other parts of the country, with the aim of adding to the general knowledge of the role of herbivores and omnivores in the small mammal community.

MORTALITY OF LOBLOLLY PINES CAUSED BY COTTON RATS. Robert K. Rose & A. Scott Bellows, Dept. of Biol. Sci., Old Dominion Univ., Norfolk, VA 23529-0266. Since December 2002, we have studied small mammals in an oldfield habitat in southern Chesapeake, Virginia. In summer 2004, we observed many dead loblolly pine trees whose bark had been gnawed by rodents from ground level to 15-18 cm. The cotton rat, *Sigmodon hispidus*, is the only species large enough to reach to 18 cm, and they comprised >80 percent of captures on the site. We tested the hypothesis that distributions of dead pine trees and captures of rodents on the trapping grid were related. In late winter 2005, after enlarging the study area by a margin of the trap interval (12.5 m), we examined pine trees in the "cells" bounded by four grid coordinates. We measured tree diameter at 30 cm from ground level, estimated tree height for all pines ≥ 0.9 m tall, and tallied smaller seedlings. We categorized trees as unmarked, partial girdled, dead and girdled, recent partial girdled, and recent complete girdled. We determined the level of tree mortality for 2004 and observed substantial damage and some mortality as early as February. In some cells, tree mortality in 2004 was as high

as 30 percent and few trees escaped being damaged by gnawing. Although vegetative cover was not quantitated, late winter gnawing of pine bark by rodents was more extensive in cells with fewer trees and more ground cover.

EVIDENCE OF FACULTATIVE REST-PHASE HYPOTHERMIA IN FREE-RANGING NORTHERN MOCKINGBIRDS DURING WINTER. Andrew S. Dolby, John G. Temple, Emily A. Kimmitt, & Kelly C. Minton, Dept. Biological Sci., Univ. of Mary Washington, Fredericksburg, VA 22401. Shallow facultative rest-phase hypothermia has been reported in a number of passerine families, but few published data exist on its use by free-ranging members of this taxon. We used temperature-sensitive radio-transmitters to determine whether Northern Mockingbirds (*Mimus polyglottos*) employ rest-phase hypothermia during winter. We measured skin temperatures of seven free-ranging mockingbirds every three hours for three to seven 24-hr cycles per subject. Nighttime ambient temperatures averaged $-0.5 \pm 7.6^{\circ}\text{C}$ (SD) and ranged from -9°C to 19°C during the study period. For all pooled observations ($n = 36$), skin temperature reductions ranged from 2.7°C to 9.5°C , while the average nightly skin temperature reduction per individual was $5.5 \pm 0.9^{\circ}\text{C}$ (SD). The average magnitude of skin temperature decline ($n = 7$) was negatively correlated with nighttime ambient temperature, and this correlation was marginally significant ($P = 0.057$). However, average depth of hypothermia was not significantly correlated with physical condition. To our knowledge, these data represent the first evidence of facultative rest-phase hypothermia in a free-ranging mimid.

CLONING AND EXPRESSION OF *ARABIDOPSIS THALIANA* β -GALACTOSIDASE-5 (At1g45130). Dashzeveg Gantulga¹, Yusuf Turan², & Asim Esen¹, Dept. of Biol. Sci., ¹Va. Polytechnic Institute and State Univ., Blacksburg, VA 24061 and ²Dept. of Biol., Balikesir Univ. *Arabidopsis thaliana* β -galactosidase-5 (At1g45130, Gal-5) cDNA was cloned and expressed in *Pichia pastoris* yielding a secreted recombinant protein. The mature protein coding region was cloned into pPICZ A expression vector. Linearized pPICZ -Gal-5 construct was transformed into *Pichia pastoris* X-33 competent cells. Transformants able to grow on Zeocin-YPDS plates were transferred to MM X-Gal plates and screened for -galactosidase activity. Several blue colonies were selected for small-scale induction in liquid culture. A colony showing highest -galactosidase activity was chosen for large-scale induction in liquid culture. More than 90% of -galactosidase activity was found in culture medium. For this colony, optimum induction medium and time course was investigated. *Pichia*-expressed recombinant -Gal-5 was partially purified by hydrophobic interaction chromatography and ion exchange chromatography and hydrolyzed pNPGal, oNPGal, 4-MUGal, X-Gal and 6-BNGal with optimal activity at pH 4.0 and 40°C . -galactosidase activity was inhibited by D-galactose but not by lactose. SDS inhibits the enzyme activity of Gal-5. The enzyme was stable at 4°C for a month.

THE EFFECTS OF MEPROBAMATE ON THE LARVAL STAGE OF THE BLACK BLOW FLY, *PHORMIA REGINA*. Rebecca G. Doane & Michelle R. Peace, Forensics Science Program, Virginia Commonwealth Univ., Richmond, VA 23284. The life cycle of *Phormia regina* and other insects can be used to estimate post-mortem interval (PMI) by estimating age of insects. Drugs ingested *ante mortem* by the deceased can affect the larval stage life cycle and size of larvae feeding on the deceased. We determined the effect of meprobamate on the larval stage duration and length and weight of *P. regina* maggots. Flies were wild trapped and maintained in a laboratory colony on a diet of sugar water and pork loin. After oviposition, approximately 100 eggs were placed on about 60 grams of homogenized pork (drug free control or drug laden samples containing 260, 520, or 1040 mg/kg meprobamate). The maggots were reared at 20°C and under 24 hour light. When the maggots migrated they were harvested, washed, and frozen. Meprobamate did not significantly affect the duration of the larval stage, but significantly increased length of larvae (lowest and highest doses, $p < 0.0001$) and the mass of larvae (highest dose, $p < 0.0001$). Since larval age is estimated by larval length, our results indicated that the PMI estimation may be affected by an ingestion of meprobamate prior to death.

BACTERIAL DIVERSITY IN A COMMERCIAL AND A NON-COMMERCIAL CAVE. Samuel I. Ralls, Kristy N. Haskins, Nina T. Parker & Luis Espinasa, Shenandoah University, Winchester, VA. 22601. Researchers suspected that cave environments are susceptible to human disturbance. A pilot study was initiated to determine if human interaction changed bacterial diversity within commercial, non-commercial, and wild cave areas in the Hupp's Hill region of Northern Shenandoah Valley, Virginia. Enumeration of each unique morphospecies (colony morphology) was determined and representatives were isolated for further testing. Results based on the Shannon Diversity Index suggested that human interaction did have an impact on bacterial biodiversity.

VENTILATORY PUMP EFFECT ON THE GILL CIRCULATION IN THE BLUE CRAB, *CALLINECTES SAPIDUS*. E. K. Brady, T. Wilkes & D. Jorgensen, Biol. Dept., Roanoke Coll., Salem, VA 24153. Blue crabs use two sets of gills for gas exchange. Each set is enclosed in a lateral space, the branchial chamber (BC). Each BC is ventilated by a muscle-driven pump, the scaphognathite (scaph), which generates negative hydrostatic pressure that pulls seawater through the BC unidirectionally past the gills. Hemolymph pools in the infrabranial sinus (IB) located just upstream from the gill circulation and collects, after passing through the gill circulation, in the pericardial space (PS) before being pumped by the heart into the systemic circulation. We measured hydrostatic pressure in the BC concurrently with hemolymph pressure in the PS and IB (allowing for calculation of pressure drop [P_{drop}] across the gill circulation) in crabs walking on an underwater treadmill. Ventilation rate increased several-fold during exercise, driven by increased scaph activity causing a decrease in BC pressure. We hypothesized that reduced BC pressure would result in passive dilation of the hemolymph channels in the gill lamellae, resulting in decreased P_{drop} . During periods of increased ventilatory pump activity we observed a decrease in P_{drop} across the gill circulation, supporting our hypothesis, and suggesting passive augmentation of hemolymph flow during periods of increased metabolic demand.

INFLUENCE OF RETINOIC ACID ON DIFFERENTIATION OF CULTURED EMBRYONIC CHICK DUODENA. J. Orion Rogers, Dept. of Biol., Radford Univ., Radford VA 24142. A survey of the literature reveals that retinoic acid (RA), a derivative of vitamin A, affects vertebrate developmental processes. The objective of this project was to determine the effects of 10^{-6} M RA on the differentiation of intestinal epithelium from 14-day-old chicken embryos incubated for 48 hours at 38 °C in culture medium 199 containing either 0.7, 1.3 or 2.8 mM extracellular Ca^{2+} . The hypothesis tested was that RA treatment will result in increased numbers and equal distribution of goblet cells along previllous ridges compared to controls. Tissue was fixed in Carnoy's fixative, dehydrated, cleared with HemoDe, and embedded in paraffin. Ribbons of 5 μm thick sections were cut, and goblet cells were stained by the periodic acid-Schiff (PAS) procedure with fast green as a counterstain. Glycogen was removed by a 30 minute pretreatment with 0.5% amylase. Both goblet cell number and previllous ridge height increased significantly from 14 to 16 days in uncultured tissue. RA had a dramatic and unexpected effect of inhibiting previllous ridge growth and goblet cell development, but RA had no deleterious effect on tissue morphology. Increasing extracellular Ca^{2+} resulted in an increase in goblet cell number, but it had no consistent effect on previllous ridge height or goblet cell distribution.

EFFECTS OF LEAD CHLORIDE ON ENDOTHELIAL CELLS. Erik Thorell & Rosemary Barra, Department of Biology, University of Mary Washington, Fredericksburg, VA. 22401. Endothelial cells are constantly exposed to foreign substances via blood and lymph, and as such are at risk of cellular insult. This study investigated the effect of PbCl_2 , as a cellular stress factor, on HSP 70 expression in CRL-2163 cells. The data indicated that treated and control cells produced similar levels of HSP 70, rendering the study inconclusive. After observing changes in cell morphology between the treated cells and control cells the study was altered to investigate the rate of apoptosis. Apoptosis was determined using fluorescence staining (AnnCy3 and 6-CF) and showed a definite difference between control and treated cells as well as between different concentrations of PbCl_2 .

(2.5mM and 7.5mM). Following a 6 hour incubation period, the treated cells exhibited beginning stages of apoptosis, whereas at 12 hours apoptosis was more widespread in the cultures treated with either 2.5mM or 7.5mM PbCl₂. The results indicated that although no difference was discerned in HSP 70 levels, changes are occurring in the cells due to PbCl₂ treatment which may be triggering apoptosis.

GENETIC ANALYSIS OF ISOLATED COTTON STAINER POPULATIONS: PRELIMINARY RESULTS. Chevon N. Dunnings, Linnea Harper, Alicia G. Middleton, Amber L. Richards, Tiffany J. Schuldt, Kara G. Segna, Fallon A. Shippen, Lisa S. Webb, & Harold J. Grau, Department of Biology, Chemistry and Environmental Science, Christopher Newport University, Newport News, VA 23606. We investigated possible genetic polymorphisms among several geographically isolated populations of St Andrew cotton stainer (*Dysdercus andreae*) on St. Thomas, U.S. Virgin Islands. Geographic isolation of these populations could lead to some degree of genetic distinction, and an earlier morphological analysis has shown that phenotypical differences exist between these populations. We have successfully extracted DNA from dried specimens of *D. andreae* and used polymerase chain reaction procedures to amplify segments of genes from both the mitochondrial and nuclear genomes. We utilized restriction endonuclease digestion to confirm the identity of the amplified sequences. We will use these procedures, along with DNA sequencing of the amplified segments, to analyze the remainder of the isolated populations for genetic polymorphisms.

REACTIVE OXYGEN SPECIES IN A MODEL OF NEURODEGENERATION. Jennifer A. Hurd¹, Nena Fox², Doug Oliver¹ & David A. DeWitt^{1,3}, ¹Dept. of Biol., Liberty Univ., Lynchburg, VA 24502, ²Dept. of Microbiology, Univ. of Virginia and ³Dept. of Pathology, Univ. of Virginia, Charlottesville, VA 22908. Increasing evidence points to a role for apoptosis and oxidative stress in Alzheimer's disease. We previously developed an *in vitro* model of neurodegeneration by triggering apoptosis using human NT2 cells treated with 500 μ M aluminum maltolate (Al) or 500 nM staurosporine. Both of these agents induced peri-nuclear clustering of mitochondria. RedoxSensor red and MitoTracker green were used to determine whether these agents induced the production of reactive oxygen species (ROS) in conjunction with organelle clustering and apoptosis. Staurosporine treated cells showed evidence of increased ROS production while Al treated cells did not. In both cases, mitochondria were clustered near the nucleus. These results show that Al induced apoptosis occurs without ROS production. They further suggest that that ROS production and organelle clustering are independent events. Supported by National Institutes of Health AG-020996 and an Undergraduate Research Award from the Virginia Academy of Sciences.

Biomedical and General Engineering

PRE-CLINICAL INVESTIGATION OF THE MECHANISM OF ACTION OF THE NOVEL PLATINUM COMPOUND *bbr3464*, Louise Lingerfelt¹, Derk Bemeleit², Christine Billecke³, Oliver Bogler³, Nicholas Farrell⁴ and Anthony Guiseppi-Elie^{1,5}, ¹Center for Bioelectronics, Biosensors and Biochips (CB3), ²University of Bremen, Germany, ³University of Texas MD Anderson Cancer Center, ⁴Dept. of Chemistry, VCU, ⁵Dept. of Chemical and Life Science Engineering, VCU. This study examined the response of glioma cell lines derived from astrocytoma to platinum-based drugs, *BBR3464* and cisplatin, based on gene expression. *BBR3464* is a new platinum-based chemotherapeutic that has demonstrated greater cytotoxicity at a lower concentration compared to the more widely used platinum-based chemotherapeutic cisplatin. A comparative study using custom spotted 10K DNA microarrays was performed. The cell lines LN243 and LN2-308 were chosen as a model system representing *p53* wild-type and *p53* null status, respectively. The results of the 10K C3B oligonucleotide array were compared to identical samples run on an Affymetrix™ oligonucleotide array. The cross-platform comparison was used for identifying the most robust filtration and normalization method as well as removing false positive results from the sample. Additionally the influence of the *p53* null mutation compared to the *p53* wild-type status was shown.

DESIGN AND FABRICATION OF AN IMPLANTABLE LACTATE AND GLUCOSE SENSOR, Gopakumar Sethuraman¹, Sean Brahim¹ and Anthony Guiseppi-Elie^{1,2}, ¹Center for Bioelectronics, Biosensors and Biochips (C3B) and ²Department of Chemical and Life Science Engineering, VCU. Biosensors are analytical devices incorporating a biological material or a biomimic (e.g. Tissue, microorganisms, organelles, cell receptors, enzymes, antibodies, nucleic acids etc.), intimately associated with or integrated within a physiochemical transducer or transducing microsystem, which may be optical, electrochemical, thermometric, piezoelectric or magnetic. To address the engineering challenges of designing and packaging of the lactate biosensor a set of solutions is proposed. The aim is to produce a working biosensor for animal implantation studies. The bioelectrode will be of microdisc design. It will be packaged into suitable chip carriers and have the bonding pads of the bioelectrode wirebonded to the pads of the package. Suitable biomedical grade silicone sheathed wires will be soldered to the chip package. A silver reference electrode will be electroplated onto the bioelectrode. Final steps in packaging include passivating the connections and coating the bioelectrode in a protective layer, possibly with the negative tone photoresist SU-8. After packaging, the biorecognition layer will be applied to the working area of the bioelectrode. The biosensor then will undergo in vitro testing, before being placed into the animal for in vivo testing.

VISUALIZATION AND FLOW MEASUREMENTS IN MICROFLUIDIC SYSTEMS. T. Bayraktar, Department of Chemical Engineering, Hampton University, Hampton, VA 23668 and S. B. Pidugu, Department of Engineering Technology, University of Arkansas at Little Rock, 2801 South University, ETAS 227D, AR 72204-1099. The microfluidic devices have recently attracted tremendous interest due to their potential of bringing novel applications into reality in many areas including biomedical industry. The microfluidic systems refer to the fluid transport systems having the characteristic length in the range of 1 to 1000 μ m. These systems utilize two modes of fluid pumping: pressure-driven or electrokinetic. One of the motivations of employing miniaturized fluid transport systems is to produce highly integrated and parallel processing devices for the analysis of clinical samples. However, the challenges in the design of microfluidic devices still remains since all aspects of fluid flow in microchannels have not been fully understood yet. The miniaturization of the flow system leads to the significant increase in the surface forces. Thus, micro scale flows deviate considerably from macro scale flow models. Non-intrusive diagnostic techniques are important tools to understand underlying principles of microflow physics. The primary goal of this paper is to present an extensive overview of flow diagnostic techniques suitable for microfluidic systems.

MOLECULARLY ENGINEERED P(HEMA) BASED HYDROGELS FOR IMPLANT BIOCOMPATIBILITY, Sheena Abraham¹, Anthony Guiseppi-Elie^{1, 2} ¹Center for Bioelectronics, Biosensors and Biochips (C3B), ²Department of Chemical and Life Science Engineering, VCU. Hydrogels based on a 2-hydroxyethyl methacrylate (HEMA) backbone crosslinked with tetraethylene glycol (TEGDA) and molecularly engineered using two methacrylate-based monomers, poly (ethylene glycol) (200) monomethacrylate (PEGMA) (0.0 - 0.5 mol %) and 2-methacryloyloxyethyl phosphorylcholine (MPC) (0 – 10 mol %) were investigated. Characterization studies involving determination of the degree of hydration and dynamic contact angle studies showed that the hydrogels exhibited increased hydrophilicity with increased MPC content and increased hydration equilibration periods. Cell viability and proliferation studies using human muscle fibroblasts and cell viability studies using human aortic muscle endothelial cells proved that the hydrogels are non-cytotoxic (viability > 80%), and controlled proliferation (< 50%). Prominent reduction in protein adsorption (up to 90%) was seen in hydrogels hydrated for 5 days as compared to hydrogels hydrated for 2 hours.

Poster Presentations

CHARACTERISTICS OF CARBON REINFORCED PIEZOELECTRIC COMPOSITE, Karla Mossi^{1,a}, Byron Smith¹, Makram Mouhli¹, and Robert G. Bryant², ¹Virginia Commonwealth

University, Richmond VA, USA, ²NASA Langley Research Center, Hampton VA, USA. Prestressed piezoelectric Unimorphs have added durability, strength and enhanced out of plane displacement, when compared to piezoelectric materials alone. Hence a variety of composite piezoelectric actuators are available such as Cymbals, Thunders, Rainbows, and Lipcas among others. This study concentrates on the characterization of Lipca devices through surface mapping, and out-of plane displacement in tension and compression. Results are compared to projected numerical approximations using beam theory. The resulting three-dimensional shape of the device is predicted by using a 23-term Rayleigh-Ritz model.

MAGNETICALLY CONTROLLED BRAKING SYSTEM, Jonathan Moon, Jeffrey King, Chris Call, Peggy Collier, Eric Haskell, Karla Mossi and Zoubedia Ounaies, Dept. of Mechanical Engineering, VCU. The scope of the project is to design and construct a compact magneto-rheological brake using Magneto-Rheological (MR) fluid. The MR fluid mechanism is such that, in the absence of a magnetic field, the fluid can act as a lubricant. Upon introduction of a magnetic field, the MR fluid becomes viscoplastic and develops a yield strength. This yield strength will be utilized to make a semi-rigid connection between an input and output. Depending on the intensity of the applied magnetic field, the viscosity of the fluid is controlled or tailored to create the desired braking force between contact points in the brake housing. The magnetic field will be supplied by an electromagnet. The device as envisioned has numerous applications such as automobile braking systems, braking systems for space rovers, and possible vehicle transmissions, however the focus in this project will be on a braking. This device can be used as a brake by applying the field at a separate point in the brake causing a semi-rigid connection between the wheel and the transmission housing, thus causing a stopping effect at that wheel. The result will be a modular part that is easily manufactured, efficient, and cost effective.

Botany

SECRETED α -AMYLASE FROM *ARABIDOPSIS*: CELLULAR LOCALIZATION AND INFLUENCE ON STARCH METABOLISM. E.A. Doyle, A.M. Lane, J.M. Sides, B. Edwards, J.D. Monroe, Department of Biology, James Madison University, Harrisonburg, VA, 22807. The *Arabidopsis* gene *AMY1* encodes an α -amylase that is expressed in leaves and contains a typical signal sequence suggesting that it is secreted. Because leaf starch is normally confined to chloroplasts, the function of a secreted leaf amylase is enigmatic. We hypothesize that the AMY1 α -amylase acts on starch in dead cells after membrane deterioration. We obtained two T-DNA mutants in the amylase gene, *amy1-1* and *amy1-2*, neither of which contains a prominent amylase activity band (A1) on native, starch-containing PAGE. Transitory starch metabolism in mutant leaves is normal. To address the cellular localization of A1 we constructed plants containing either AMY1:GFP or GFP alone under the control of the 35S promoter. Transgenic plants over-express the A1 protein as observed on native PAGE, and GFP was observed using protein gel blots probed with anti-GFP antibodies. Infiltrating leaves with Proteinase K resulted in complete degradation of the AMY1:GFP fusion protein while the cytosolic GFP was unaffected in the absence of cell lysis. Consistent with its hypothesized role in degrading starch after stress-induced cell death, the *AMY1* gene is induced during senescence and by abscisic acid.

THE *FLORA OF VIRGINIA* PROJECT: A 2004-2005 UPDATE. Marion B. Lobstein, Department of Biology, Northern Virginia Community College, Manassas, VA 22205. Virginia, for its landmass, has the most diversity of vascular plant species of any state in the United States. It had the first flora, the *Flora Virginica* in 1739, yet it does not have a modern flora. The Virginia Academy of Science for over fifty years has supported efforts to produce a modern flora of Virginia. The Foundation of the *Flora of Virginia*, Inc, was formed in 2001 and in May 2002 received 501(c)3 status. Progress continues to be made on the efforts to develop a flora of Virginia including fund-raising and public

outreach efforts. Work on the content of the *Flora of Virginia*, including nearly 600 illustrations, has been commissioned, completed and supported by VAS funds. Funds awarded from the Gwaltney Memorial Trust for 2005 will be used to support continuing work on illustrations. The Academy and its Fellows continue to provide essential support, including financial support, for this project. Other progress includes completion of treatments of the dichotomous keys of 90 of the 205-210 vascular plant families in Virginia and the first step in developing species descriptions for approximately 10% of Virginia's 3800 vascular plant species. These efforts to develop a modern flora of Virginia by 2010 have taken root and continue to make substantial progress.

PRELIMINARY PHYLOGENETIC ANALYSIS OF *MORTONIA* (CELASTRACEAE) USING ITS SEQUENCE DATA. Jennifer A. Clevinger¹, Curtis C. Clevinger², Brent A. Huskey¹, Matthew M. Beegle¹, Zubin J. Joseph¹ & James Henrickson³, ¹Department of Biology, James Madison University, Harrisonburg, VA 22801, ²Fishburne Military School, Waynesboro, VA and ³University of Texas at Austin. *Mortonia* A. Gray is a member of the family Celastraceae, which is comprised of about fifty genera of trees and shrubs. *Mortonia* is found in California, the southwestern US, Texas and Mexico. Phylogenetic relationships were examined using DNA sequence data from the internal transcribed spacer (ITS) region. Sequencing of PCR products revealed that *Mortonia* individuals have ITS regions containing polymorphic sites and therefore had to be cloned. Preliminary phylogenetic analysis suggests that a morphological variant of *Mortonia palmeri* collected by Henrickson in Nuevo Leon, Mexico should be recognized as a new species because it does not fall in the same clade as the typical *M. palmeri*. Analysis also suggests that subgenus *Mortonia* is monophyletic but subgenus *Greggii* is not. Furthermore, the two collections of *Mortonia latisejala* are not sister, so more collections will be sequenced to determine the monophyly of this species.

VASCULAR PLANT INVENTORY OF POWHATAN COUNTY, VIRGINIA. Michael A. Terry & W. John Hayden, Department of Biology, University of Richmond, Richmond, VA 23173. Between August 2003 and May 2005, a floristic inventory of Powhatan County, located in the piedmont province of Virginia, was conducted. Bedrock is dominated by metamorphic and igneous rocks of Proterozoic to Paleozoic age dissected by the James and Appomattox Rivers and their tributaries. Commercial forest (mostly pine) occupies 75% of the land area and natural vegetation in the county includes various hardwood communities. The goal was to produce a thorough vascular plant inventory for this largely rural county currently experiencing exurban development pressure. The annotated checklist is based on new field collections supplemented with records from regional herbarium collections and the *Atlas of the Virginia Flora*. Field work sampled habitats consistent with at least 12 distinct community groups recognized in Virginia. The checklist contains 1017 taxa, representing 514 genera and 150 families. Eighteen percent of the species are naturalized introductions. Sixteen newly collected specimens (1.5% of the total) represent rare plants on Virginia's watch lists, and 114 collections (11% of the total) represent new records for Powhatan County, including two potential state records.

COMPARISON OF HYDROPHILIC ANTIOXIDANT CONCENTRATION AMONG FREEZE-DRIED AND FRESH FRUITS. Michael H. Renfroe & Guillermo S. Calica, Department of Biology, James Madison University, Harrisonburg, VA 22807. Dietary antioxidants help prevent diseases such as cancer by counteracting the damaging effects of free radicals. Different fruits are likely to contain different total concentrations of antioxidants. Also, food processing such as freeze-drying may affect antioxidant content. Hydrophilic antioxidant concentrations from fresh and freeze-dried fruit tissue were quantified using spectrophotometric measurement of ABTS (2,2'-azino-bis-(3-ethylbenzthiazoline-6-sulfonic acid) radical decoloration. Measurements were converted by a standard curve to Trolox equivalents. Antioxidant contents of five freeze-dried fruits were compared to their fresh counterparts to determine if freeze-drying has an effect. Hydrophilic antioxidant concentration was greatest in strawberries with significantly ($p=0.05$) lesser concentrations found in raspberries, blueberries, bananas and peaches (listed in descending order). Freeze-drying

decreased hydrophilic antioxidant content in strawberries but increased hydrophilic antioxidant content in the other four fruits. This suggests that freeze-drying is not detrimental to the release of hydrophilic antioxidant molecules in all fruits, but its effects may vary with fruit type.

THE CENTRAL VIRGINIA BLUE RIDGE: RESEARCH OPPORTUNITY IN A NARROW ANCIENT CORRIDOR OF MIGRATION AND ECOSYSTEMS. Douglas A. Coleman, The Wintergreen Nature Foundation, Nellysford, VA 22958. From Humpback Mountain north past Rockfish Gap into Shenandoah National Park, the Blue Ridge contracts to a single mountain spine. On its east and west flanks are lands disturbed by urban development and agriculture. This range--an ancient corridor of migration and population continuity--remains important, but it is threatened. Concentrated raptor and neotropical bird migrations are well documented at Rockfish Gap. Black bears (*Ursus americanus*) are often thwarted or killed here as they attempt to cross two major highways. Preliminary research also shows narrow nesting habitat preferences for wood warblers (*Dendroica*). Less is known about macroinvertebrates, but threats to migration and gene pool continuity can be inferred. Elements of late Pleistocene flora appear in both disjunct and relict communities. Recent research funded by The Wintergreen Nature Foundation also indicates continuous Native American occupation for the last 9,000 years and significant trade associated with east-west passage through mountain gaps in the central Blue Ridge. The Foundation invites and offers assistance for visiting students and scientists whose research supports conservation efforts in this region.

A PRELIMINARY STUDY OF THE GENUS *Cordia* (BORAGINACEAE) IN THE GALÁPAGOS ISLANDS. Conley K. McMullen, Department of Biology, James Madison University, Harrisonburg, VA 22807. The genus *Cordia* L. (Boraginaceae) is well represented in the Galápagos Islands and may comprise up to seven species. As currently understood, four of these species are endemic, two are probably native and one is introduced. However, three of the four endemics are not readily distinguishable based on available descriptions. The endemics and natives are thought to have originated in the western (Andean) region of South America, and they are believed to have arrived in the archipelago via long-distance dispersal by birds. In habit, Galápagos members of the genus *Cordia* range from low-growing shrubs to small trees, and they occupy both arid lowlands and moist uplands. The proposed study will use a variety of characters (morphological, palynological, reproductive, molecular) to determine relationships between these species, focusing on the endemic members. Results will be used to prepare a much-needed taxonomic revision of these endemics. An added benefit of this study is that it will provide Galápagos conservation officials with updated nomenclature for the genus, a clear understanding of species limits and relationships, and reliable records of species distributions.

PHYLOGENETIC ANALYSIS OF *matK* PSEUDOGENE FORMATION IN THE SUBTRIBE AERIDINAE (ORCHIDACEAE): TAXONOMIC DISTRIBUTION AND ORIGIN TESTING. K. B. Pittman & D. C. Jarrell, Dept. of Biological Sciences, Univ. of Mary Washington, Fredericksburg, VA 22401. The chloroplast locus encoding the putative RNA maturase, *matK*, is arguably the fastest evolving protein coding sequence of the chloroplast genome. The high rate of nucleotide substitution and variation in the position of start codons has caused some to suggest that most, if not all, plants carry *matK* as a pseudogene. This disregards research that demonstrates the presence of both transcripts and proteins from this locus. The *matK* sequences from several sister taxa in the orchid subtribe Aeridinae have frameshift deletions of 7, 8 or 10bp mostly in the 5' end of the gene. Phylogenetic analysis indicates that these taxa appear to form a monophyletic group. However, recent preliminary experiments to resolve the origin of inconsistent sequence data from certain taxa suggest the presence of two or more genes, one functional and one pseudogene. Further analysis of

this region will be necessary to determine the status of *matK* pseudogenes. To determine the status of *matK*-dependent introns, primers were designed to intron flanking regions such that in cases of loss a shorter length product would be amplified. To date, all screened introns appear to be present in our sample taxa.

PHYLOGENETIC ANALYSIS OF *PHALAENOPSIS* (ORCHIDACEAE) USING MULTIPLE CHLOROPLAST SEQUENCES. M. Laygo, B. Janelins, H. Hamed and D.C. Jarrell, Department of Biological Sciences, University of Mary Washington, Fredericksburg, VA 22401. *Phalaenopsis* (tribe Vandaeae, subtribe Aeridinae) is divided into five subgenera based on floral morphology. Convergent or divergent evolution of floral forms via plant-pollinator interactions raises concerns over the relationship between a morphology-based classification scheme and evolutionary history. Molecular systematic investigations may help resolve these inconsistencies. Sequences were generated for the *accD-psaI* spacer, the *rpl16* intron, the *matK* gene and the *rps16* intron. Due to alignment difficulties and sequence failure, respectively, analysis of the *accD-psaI* and *rpl16* regions will not be discussed. A combined analysis of the *matK* gene and the *rps16* intron supports the monophyly of *Polychilos*, a sister relationship of Proboscidioides and Aphyllae and monophyly of some sections within a paraphyletic subgenus *Phalaenopsis*. Moreover, these results suggest a need for reevaluation and potential modification of the current classification scheme.

Chemistry

A STUDY OF THE DECOMPOSITION OF THE PRODUCTS FROM THE REACTIONS of MAGNESIUM ALUMINUM ISOPROPOXIDE WITH 3,4 –DIHYDROXYBENZALDE- HYDE and CATECHOL. Amanda L. Anderson, Brycelyn M. Boardman, Donna S. Amenta, John W. Gilje Dept of Chemistry, James Madison University, Harrisonburg VA 22807. The reactions of magnesium aluminum isopropoxide, $\text{Mg}[\text{Al}(\text{OPri})_4]_2$, with 3,4- dihydroxybenzaldehyde and catechol have been studied. According to the chelate affect, the replacement of the isopropoxide groups on $\text{Mg}[\text{Al}(\text{OPri})_4]_2$ with these aromatic moieties should stabilize this normally air-sensitive compound. The resulting functional heterometallic alkoxides might be used in both chemical vapor deposition and hydrothermal materials syntheses of mixed metal oxides. The product resulting from the reaction of $\text{Mg}[\text{Al}(\text{OPri})_4]_2$ with 3,4-dihydroxybenzaldehyde appears to be $\text{MgAl}_2(\text{OPri})_6(\text{benz})(\text{solvent})_2$, where benz represents the $(3,4\text{-O}_2\text{C}_6\text{H}_3\text{CHO})_2^-$ ion and the solvent is N,N-dimethylformamide (DMF) or dimethylsulfoxide (DMSO). The product resulting from the reaction of $\text{Mg}[\text{Al}(\text{OPri})_4]_2$ with catechol, in a 1:2 ratio, appears to be $\text{MgAl}_2(\text{OPri})_4(\text{cat})_2(\text{solvent})_2$, where cat represents the $(1,2\text{-O}_2\text{C}_6\text{H}_3)_2^-$ ion and the solvent is tetrahydrofuran (THF). The thermal decomposition of the products has been studied using thermal gravimetric analysis-mass spectroscopy (TGA-MS), evolved gas analysis-infrared spectroscopy (EGA-IR), nuclear magnetic resonance spectroscopy (NMR), and differential scanning calorimetry (DSC). The results of these reactions will be discussed.

A COMPLETELY DIFFERENT MICROWAVE SPECTROMETER: REDUCING DATA COLLECTION TIME FROM 15 HOURS to 15 MICROSECONDS, Gordon G. Brown, Kevin O. Douglass, Brian C. Dian, Scott M. Geyer, and Brooks H. Pate Department of Chemistry, University of Virginia, McCormick Rd., P.O. Box 400319, Charlottesville, VA 22904 Our laboratory has developed a new broadband (11 GHz) chirped-pulse[1] Fourier transform microwave (CP-FTMW) spectrometer. The CP-FTMW spectrometer is capable of measuring a high resolution (50 kHz linewidth), 11 GHz (7 – 18 GHz range) rotational spectrum in 25 microseconds, a measurement that takes approximately 18 hours with the previous state of the art microwave spectrometer.[2] The key difference in our spectrometer is that while the traditional FTMW spectrometer scans through microwave frequencies in small (~500 kHz) steps, the CP-FTMW measures the entire 11 GHz spectrum with every microwave pulse. Signal-to-noise ratios of 100:1 can be achieved in about 10 seconds of signal averaging. Due to the decreased data acquisition time, the CP-FTMW

spectrometer is ideally suited for implementation as an analytical technique with species identification at the parts-per-billion (ppb) level.[3] Microwave spectroscopy is a potentially powerful analytical tool, due to its ability to unambiguously identify volatile species from their molecular rotational spectra “fingerprints”.

SYNTHESIS OF NOVEL ORGANIC PLATFORMS INCLUDING RIGID SCAFFOLDS AND AMPHIPHILIC CATENANES. Kevin L. Caran, Christian D. Ziegler, David M. Crizer and D. Kyle Fitzgerald, Dept of Chemistry, James Madison University, Harrisonburg VA 22807. Research in our lab on the synthesis of rigid molecular scaffolds and amphiphilic catenanes will be introduced. Molecular scaffolds are molecules that provide multiple functional groups that act as points of attachment to a variety of groups or biologically significant moieties. We have designed two isomeric scaffolds, each bearing a rigid perhydrophenalene core, which will be studied as template-assisted synthetic proteins (TASPs) and Gemini surfactant cores. Progress on our initial route and two modified routes will be presented. Synthesis and studies on a number of amphiphilic catenanes will also be discussed. Our catenanes are rendered amphiphilic by the attachment of one or more hydrophobic units to a polar [2]catenane head-group.

VIBRATIONAL DYNAMICS OF TRIFLUOROACETIC ACID AND FORMIC ACID IN GAS AND DILUTE SOLUTION: CRACKING OPEN GAS PHASE ACID DIMERS. Pam L. Crum, Brian C. Dian, Hyun S. Yoo, Charlotte E. Hinkle, and Brooks H. Pate, Department of Chemistry, University of Virginia, McCormick Rd., P.O. Box 400319, Charlottesville, VA 22904 Ultrafast time-domain transient absorption spectroscopy is used to study the vibrational dynamics of the cyclic hydrogen bonded dimers of trifluoroacetic acid and formic acid in both the gas- and solution-phase. Deposition of energy into the broad dimer bands of these acid dimers in the gas-phase provides the means to break open the dimer, as evidenced by the growth of a “free O-H” absorbance $\sim 3580\text{cm}^{-1}$ on the time scales of energy flow out of the initially excited dimer region. In trifluoroacetic acid there is no change in the rate of “free O-H” growth with varying pump frequency between 2596cm^{-1} and 3131cm^{-1} . Spectrally resolved pump-probe experiments are performed to reveal the evolution of a broad range of the spectra in time, which facilitates interpretation of the dynamics behind the time scales provided by single frequency measurements. When the acid dimers are solvated (0.05M CCl_4 solution), energy pumped into the broad dimer band can be cooled out by the solvent, making it unavailable to the process of dimer opening.

THERMAL DECOMPOSITION OF $\text{CaCu}(\text{C}_2\text{H}_3\text{O}_2)_4 \cdot 6\text{H}_2\text{O}$, Pam Dopart and T.C. DeVore, Dept of Chemistry, James Madison University, Harrisonburg VA 22807. The thermal decomposition of calcium copper acetate was studied using thermal gravimetric analysis – mass spectroscopy and differential scanning calorimetry. Powder X-ray diffraction and FT-IR were used to identify the solid residues. Calcium copper acetate decomposed through three main steps. The first was the loss of waters to form a less hydrated complex. The second was complex decomposition to produce copper (I) oxide and calcium acetate. The final step was the loss of acetone to produce calcium carbonate. The activation energies for each step were established using the OZAWA method and the enthalpy of reaction for each step was estimated from the DSC data.

AN ICP-MS TRACE ANALYSIS PROBLEM IN INSTRUMENTAL ANALYSIS. D. M. Edwards, A. M. Lakner, D. M. Downey, and J.J. Leary, Dept of Chemistry, James Madison University, Harrisonburg VA 22807. In recent years students in Instrumental Analysis at JMU have performed an experiment designed to determine the amounts of the trace nutrients chromium, molybdenum and selenium in over-the-counter vitamin/mineral supplements using an ICP-MS. Questions about the precision of the results have persisted. In this paper results of a preliminary experiment will be presented that document the completeness of the dissolution part of the experiment. The completeness of the dissolution was verified by determining the iron content in four different

vitamin/mineral supplements. Quadruplicate determinations gave results that were less than 2 mg above the specified values of 18 mg and that exhibited coefficients of variation of less than 3%. In addition, a procedure will be described that has provided results for Cr, Mo and Se in the 20 to 240 µg range with coefficients of variation smaller than 5%. Communications with vitamin manufacturers will be shared, and insights about FDA regulations will be presented.

ACTIVE SITE LABELING OF THE CLONED HUMAN CAP METHYL-TRANSFERASE AND A DELETION MUTATION. Nicholas N. Hoke and T. O. Sitz, Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061. The 5'-cap structures of eukaryotic mRNAs are methylated in the N-7-position of the guanine base by guanine-7-methyltransferase. This modification is very important for gene expression. If the methylation does not occur the mRNA is not translated into protein. Two different forms of this human enzyme were expressed in *E. coli*, a full length enzyme (476 amino acids) and a deletion mutation (120 amino acids removed from the N-terminus). These proteins were expressed as His-Tag proteins, they had 10 histidine residues at their N-terminal ends. The His-Tag allowed the enzymes to be purified on a Ni²⁺-column. When the deletion enzyme was purified from the Ni²⁺-column and allowed to sit at 4° for a couple of hours a large precipitate formed and almost no enzyme activity remained. However, in another preparation, if EDTA was added to the sample after elution from the column, little denatured protein formed and the activity was good. These two methyltransferases were then used to study the effect of Mg⁺⁺ on active site labeling with ³²P-labeled RNA. Mg⁺⁺ inhibited the binding to the full length methyltransferase of non-methylated capped RNA at concentrations as low as 10 mM. The divalent metal did not inhibit the binding of non-methylated capped RNA to the enzyme with 120 amino acids deleted from the N-terminal end.

MICROWAVE ATTENUATION OF LIQUID MIXTURES. Christopher T. Lloyd, D. Jason Sames and Robert F. Cozzens, Chemistry Division, US Naval Research Laboratory, 4555 Overlook Avenue, SW, Washington, DC 20375. There is need for a technique that can be used for the experimental simulation of varying microwave transmission through a charred material. Radio and microwave transmission are only two such frequencies that are attenuated by charred surfaces or materials. In attempts to study this characteristic, other methods were sought for producing similar attenuation responses using absorbing liquids. Because water molecules are dipoles that freely rotate and are very strongly hydrogen bonded, this polar liquid is a very efficient microwave absorber. While much of the previous literature has focused mostly on higher frequency ranges, it was noted that attenuation (by water) and frequency is an exponential relationship and could be very helpful in understanding attenuation of radio communication signals or radar transmission at lower frequencies. Water is known to be the strongest liquid absorber, yet mixtures of water and alcohols/glycols can afford some control over attenuation by decreasing it. In addition, the thickness of the liquid can also be used to manipulate attenuation.

SYNTHESIS OF ANTIFUNGAL VINIFERINS; THEIR RELATIONSHIP TO YOUNG VINE DECLINE. David M. McGinnis and Roy L. Williams, Old Dominion University Enological Research Facility, Department of Chemistry and Biochemistry, Old Dominion University, Norfolk VA 23529-0126. Young vine decline has become an international problem for vineyards. This disease is induced once a grapevine is infected with the *Phaeoacremonium chlamydosporum* fungal pathogen. The crude fungal product has been isolated and analyzed in our laboratory with the use of HPLC and LC/MS instrumentation. We have detected three major phytoalexins(trans-resveratrol, -viniferin, -viniferin) within this crude fungal product. Oxidative dimerization of trans-resveratrol, when in the presence of laccases, will lead to the natural formation of viniferin compounds. We have recently been able to synthesize authentic standards of each of the mentioned viniferins to help confirm the identity to the fractions we have isolated and such data will help explain the relationship between viniferins and young vine decline.

THE CHEMISTRY OF $\text{Ph}_2\text{P}(\text{CH}_2)_n\text{P}(\text{O})\text{Ph}_2$ WITH HARD AND SOFT LEWIS ACIDS. Ashley Rose, Donna Amenta and John Gilje, Department of Chemistry, James Madison University, Harrisonburg VA 22807. We are interested in synthesizing heterobimetallic complexes containing a transition metal and a lanthanide metal. These complexes have possible applications as sensors and catalysts. Thus, we are studying the coordination chemistry of $\text{Ph}_2\text{P}(\text{CH}_2)_n\text{P}(\text{O})\text{Ph}_2$ with $n = 1, 2$, which should complex mid to late transition metals through the phosphine phosphorous and electropositive metals through the oxygen of the phosphine oxide moiety. The reaction of these ligands (L) with NaXCl_2 , where $X = \text{Pt}, \text{Pd}$, is known to produce *trans*- $\text{X}(\text{L})_2\text{Cl}_2$. These complexes were allowed to react with several types of lanthanide salts with hopes of forming heterobimetallic complexes with the formula $\text{Ln}(\text{Y})_3(\text{L})_2\text{XCl}_2$ ($\text{Ln}(\text{Y})_3 = \text{Nd}(\text{OTf})_3, \text{Ce}(\text{OTf})_3, \text{Tb}(\text{NO}_3)_3, \text{Ce}(\text{NO}_3)_3, \text{Tb}(\text{ac-ac})_3$). While x-ray quality single crystals have not yet been obtained, we have NMR evidence that indicates the existence of P-O-Ln units and the preservation of the ligand coordination to the transition metal.

PURIFICATION OF THE CLONED HUMAN mRNA CAP METHYL-TRANSFERASE. M.J. Rothenberg & T.O. Sitz, Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061. The methylation of the 5'-cap structure in eukaryotic mRNA is essential for gene expression. Previous research has shown that this enzyme isolated from various tissues exists as a homodimer. In order to study the subunit interactions of the cloned human methyltransferase high purity of the enzyme is required. The cDNA for the methyltransferase was cloned in a pET16B plasmid and the enzyme was expressed in *E. coli* as a His-Tag protein (10 histidine residues at the N-terminal end). This allowed the enzyme to be purified on a Ni^{+2} -column. The methyltransferase binds to the column and is eluted with imidazole buffer. While this is a good purification step, the enzyme is only about 80% pure as observed on SDS-polyacrylamide gels. Further attempts to purify the enzyme on two different types of Mono-Q columns (anion exchange chromatography) resulted in dramatic loss of activity. When enzyme is diluted activity is lost but can be reactivated in the presence of substrates. We propose a model of the inactivation of the enzyme. The homodimer may dissociate upon dilution and lead to loss of activity. When the enzyme is assayed a large increase in activity is observed after about 90 minutes. We believe the binding of substrates to the enzyme allows the enzyme to reform the active homodimer resulting in the resurrection of the methyltransferase activity.

ANALYSIS OF MONOTERPENES REMAINING IN WOOD FROM OLD SOUTHERN YELLOW PINE STUMPS. Thomas L. Eberhardt¹, Philip Sheridan^{2&3}, and Jolie Mahfouz¹. ¹Southern Research Station USDA Forest Service, ²Meadowview Biological Research Station, ³Dept. of Biology, Old Dominion University. Old, resinous pine stumps with axe-cut turpentine boxes can be found in the forests of southeastern Virginia. These stumps were presumably once longleaf pine trees since this species was almost exclusively used for the extraction of turpentine by the colonists. We used GC/MS and specific gravity measurements to determine whether we could identify the stump samples to specific pine taxa. Since limonene is found in high concentration in pond pine, and all our samples had low level of this compound, we were able to eliminate pond pine as a candidate species. Monoterpene composition of the stump samples did not allow us to determine whether they were longleaf or loblolly pine. Specific gravity measurements disclosed a high level of non-volatile extractives in turpentine stump samples. Part of the identification problem is that there are no standards for comparing old pine samples of unknown origin to. The identification of these stump samples is important in assisting conservation biologists in properly restoring degraded ecosystems and phytogeographers in mapping the historical distribution of indigenous taxa.

ANALYSIS OF NON-METHYLATED CAP STRUCTURE MRNA ISOLATED FROM VARIOUS TISSUES. Nicole M. Tellmann, Ayanna L. Walker & T. O. Sitz, Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061. The 5'-ends of eukaryotic mRNAs are highly modified forming what

is called a “cap” structure. The most important of these modifications is the methylation of the N-7-position in the guanine base. Without this modification the mRNA is not functional. Messenger RNA is undermethylated at this site in tumor cells. We have developed a rapid assay for the hypomethylation of the cap structure using cloned human guanine-7-methyltransferase and a DEAE-filter method that allows us to analyze many samples quickly. Our laboratory has previously shown that un-methylated cap structure is found in the post-polysomal cell fraction isolated from various tissues. We isolated post-polysomal RNA from two different human cancer cell lines, mouse liver, and mouse liver from mice treated with the amino acid analog ethionine. The RNA from normal tissue (mouse liver) had the lowest level of hypomethylation. Ethionine, the ethyl amino acid analog of methionine, is metabolized in liver to form S-adenosylethionine which is a substrate inhibitor of many methyltransferases. Post-polysomal RNA isolated from ethionine treated mice had the highest level of hypomethylated cap structures. Both cancer tissue culture cell lines (HOS & HeLa) had slightly elevated levels of non-methylated cap structure.

NATURAL ENDOCRINE DISRUPTORS (EDCs) IN LOCAL WATERS. R.L. Williams, Department of Chemistry/Biochemistry, Old Dominion University, Norfolk, VA, 23529-0126. This laboratory has continued to investigate the possible impact of natural endocrine disruptor compounds (EDCs) in local waters. We are especially interested in the presence of these natural EDCs in drinking water sources and the effects, if any, of the distribution process on the integrity and composition of these compounds. Sample of raw Lake Drummond water from Suffolk, VA have been shown to contain detectable levels of three important isoflavonoid phytoestrogens that are considered to be natural EDCs. Using a new approach described as "slurry chromatography", we have been able to separate and identify two important natural EDCs in raw water samples from the Norfolk and Newport News waterworks. The two isoflavonoid EDCs found in the Lake Drummond, Norfolk and Newport News raw waters were identified as daidzein and genistein. An analysis of finished water samples using the "slurry chromatography" method has shown that daidzein is relatively inert to the disinfection process, but that genistein is apparently degraded to several disinfection by-products (DBPs). The nature and potential EDC capacity of these new DBPs is under investigation. Other local water samples are currently under investigation for the presence of the same EDCs.

Computer Science

A PHP-MYSQL-BASED IMPLEMENTATION FOR AN ONLINE BANKING SYSTEM. Kelli J. Outlaw & Huiqing H. Yang, Dept. of Mathematics and Computer Science, Virginia State University, Petersburg, VA 23806. Internet banking is a fast and convenient way to manage customer's finances. With the increasing population of Internet customers and demand for payments via the Internet, it is necessary and significant for banks to extend their services to customers on the Internet. Recently, as a powerful database server, MySQL has evolved into an RDBMS with the rich feature set to meet online application requirements. It performs well on the majority of queries, and especially it support PHP server-side script language. In this paper, an online banking system is developed by utilizing PHP technology with MySQL server running on Linux. The system mainly consists of HTML pages, PHP files and relational tables resided in MySQL database. The system provides individual customer with online services such as access their account, view current balances and transactions, transfer money between different accounts, update personal information, and so on. Regarding to security issue in an online banking, secure features in the server side have been concerned in the paper. Online simulation shows that the system can meet the requirements of individual customers.

THE MULTIDISCIPLINARY DEGREE IN BIOINFORMATICS. Jeff Zadeh, Department of Mathematics and Computer Science, Virginia State University, Petersburg, VA 23806. This paper investigates the role of the multidisciplinary in bioinformatics and its importance which

supports the lack of the graduate and post-graduate degree in bioinformatics. Although many universities and colleges have or are creating a new graduate program in bioinformatics, few are creating undergraduate programs to support the graduate programs. Bioinformatics is a new and rapidly evolving discipline that has emerged from the biology, chemistry, mathematics, computer science, and engineering. Largely because of the inherently interdisciplinary nature of bioinformatics research, academia has been slow to respond to the industry and government demands for trained scientists to develop and apply novel bioinformatics techniques. Most of the researches in bioinformatics relates to the discovery of the functional relationships between the composition of the genes within the context of the genome and the structure. Recent advances in genomics and structural biology have resulted in an unprecedented increase in biological data available from the various accessible databases.

A LOCAL CAR DEALERSHIP INFORMATION SYSTEM. Preston L. Gray & Huiqing H. Yang, Dept. of Mathematics and Computer Science, Virginia State University, Petersburg, VA 23806. An online information System can provides consumers with a fast and better way to get related information. In this paper, a local car dealer information system is designed. The purpose is to help people locate the closest car dealerships in their area. The system mainly contains vehicle data such as model, year, color, price, mileage and so on. The customers can view lists of used and new vehicles for sale in their area and choose a dealer. Since a good design is the foundation for good applications, constructing a semantic data model is one of the major considerations in the paper. Firstly, the data environment of a local car dealership has been examined. The main objects include vehicles, dealers and manufactures. Secondly, all relation tables are in 3rd Normal Form in order to reduce data redundancies and eliminate the data anomalies. Finally, the system is implemented by using MySQL, HTML and PHP script language. The demonstration of online querying shows the retrieval power of the car dealership information system.

Environmental Science

THE EFFECT OF SITE REMEDIATION ON THE ARBUSCULAR MYCORRHIZAE OF A MODERATELY SALINE SITE. B. B. Kreutzer, C. R. Cohill, J. M. Krouse and A. Owens. Dept. of Integrated Science and Technology, James Madison University, Harrisonburg, VA. Several mycorrhizal parameters were assessed at a southeastern Ohio moderately saline site before and after soil remediation. Mycorrhizal colonization and inoculum potential values decreased and host species richness increased.

AUTOMATED RIBOSOMAL INTERGENIC SPACER ANALYSIS (ARISA) OF FUNGAL COMMUNITIES FROM FOUR SALT-MARSH PLANTS. Albert P. Torzilli¹, Masoumeh Sikaroodi¹, David Chalkley², and Patrick M. Gillevet¹, ¹Department of Environmental Science and Policy, George Mason University, Fairfax, Virginia 22030 and ²American Type Culture Collection, 10801 University Boulevard, Manassas, Virginia, 20110-2209. ARISA was used to examine the composition of fungal communities associated with four temperate salt-marsh plants, *Spartina alterniflora* (short and tall forms), *Juncus roemerianus*, *Distichlis spicata*, and *Sarcocornia perennis*. Analysis of ARISA data by principal component analysis (PCA), principal coordinate analysis (PCO), and species diversity comparisons indicated that the fungal communities from the two grasses, *S. alterniflora* and *D. spicata* were more similar to each other than they were to the distinct communities associated with *J. roemerianus* and *S. perennis*. Principal component analysis also showed no consistent, seasonal pattern in the composition of these fungal communities. Comparisons of ARISA fingerprints from the different fungal communities and those from pure cultures of selected *Spartina* ascomycetes supported the host/substrate specificity observed for the fungal communities.

IMPACT OF AN ENVIRONMENTAL SCIENCE CLASS ON COLLEGE STUDENTS. Richard S. Groover, Department of Biology, J. Sargeant Reynolds Community College. Richmond, VA 23285. Impact on students enrolled in an environmental science course was studied. Using two questionnaires to collect the data from the sampled population: a "PRE test" questionnaire was completed by the students (146) on the first day and a "POST test" questionnaire was completed (131 students) on the last day of the course. The proportion of students who considered themselves environmentalists increased 52 % by the end of the course. Asked how much time they would spend studying political candidates' (ie. running for governor) voting record on environmental issues, a mean value of 12.2 minutes occurred in the PRE test and a mean value of 16.2 minutes in the POST test, but a statistically significant change did not occur. Asked if they would be willing to pay higher taxes to improve the environment the POST test indicated a 32 % increase in the "Yes" response, which was significant. Eighty-three percent of the students reported a change in their opinion on environmental issues, and all of these became more "pro-environmentalist."

DEGRADATION OF PYRENE AND CREOSOTE BY *PSEUDOMONAS FLUORESCENS* STRAIN 29L. Saleha Husain and Carol D. Litchfield, Dept. of Environmental Science and Policy, George Mason University, Fairfax, VA 22030. The objectives of this research was to study biodegradation of an isolated microorganism, *Pseudomonas fluorescens* Strain 29L on pyrene and creosote. Eventually, biodegradation by-products were detected and identified. Pyrene, a by-product of manufactured gas processes, is a persistent PAH (polyaromatic hydrocarbon) in the environment due to its low aqueous solubility. It is a component of creosote. Results for the pyrene study indicated that more growth occurred with 24 ppm than with 300 ppm pyrene. Unknown spots as well as spots matching standards were detected on TLC (thin layer chromatography). GC-MS (gas chromatography mass spectrometry) results indicate a number of benzene-related compounds and short chain acids. Results for creosote study indicated faster growth than in pyrene as well as decrease in creosote components in the presence of 29L. The techniques used in this study can be applied to determine synergistically toxic effects of by-products from biodegradation of PAHs.

INVESTIGATION OF THE HALOPHAGE FROM THE GREAT SALT LAKE. Sarah Strom & Carol Litchfield, Dept. of Biol., George Mason Univ., Fairfax VA. 22030-4444. Halophages are viruses that attack halophiles, which are salt-loving bacteria. Depending on which halophile the halophage is specific to it can destroy a whole laboratory stock. So far scientists have only been able to isolate and study fifteen halophages. One of the topics that scientists have been trying to prove is that halophages are important in controlling the amount of halophiles that can occur in a natural environment. Another issue is the specificity of halophages in controlling the number of species that can inhabit a hypersaline environment. The Great Salt Lake is the largest terminal hypersaline lake in Northern America. This is where the halophages that will be studied will come from. The goal of this research is to isolate halophages and determine their specificity and their burst size. If possible, their DNA will be extracted, studied, and then compared with other known halophages as well. Given this information, science will be that much closer to understanding how halophiles and halophages bring a balance in nature.

MICROBIAL COMMUNITY DYNAMICS IN GREAT SALT LAKE. S.S.Dalmet, M. Sikaroodi, P.M. Gillevet, C. Litchfield, Department of Environmental Science and Policy, George Mason University. The Great Salt Lake is the largest hypersaline lake in the United States. It is divided into two parts by a railroad causeway. The North Arm is saltier than the South Arm. The salinity of the lake ranges from 12%- 30%. To date, the microbial community of the Great Salt Lake has not been very well studied. The aim of this paper is to study the microbial community present in the Great Salt Lake over time by using DNA fingerprinting, 16S rRNA gene cloning, and sequencing. Aseptically collected samples from North Arm were plated on different media

containing 25% salt. Total Colony Forming Units per mL were found to be from $2\text{--}3 \times 10^5$ to 10^6 . Two to three liters of surface water was aseptically collected and centrifuged and the total community DNA was extracted from the pellet. The DNA was subjected to Length Heterogeneity Polymerase Chain Reaction using fluorescent primers specific for Bacteria or Archaea. The rRNA gene was cloned using TOPO-TA kit following the manufacturer's instructions. The sequenced clones were analyzed with the Ribosomal Data Base (RDP). Data obtained show that the microbial community in the Great Salt Lake is dynamic and needs further investigation to study factors affecting this community.

A MOLECULAR COMPARISON OF HALOPHILIC ARCHAEA FOUND IN THE SOLAR SALTERN OF EILAT, ISRAEL. M. A. Craft, Department of Biology, and C.D. Litchfield, M. Sikaroodi, and P. Gillevet, Department of Environmental Science & Policy, George Mason University, Fairfax, VA 22030-4444, USA. Two samples, E2 and E3, from the saltern crystallizer ponds of the Israel Salt Company, Eilat were amplified using PCR, ligated, transformed, and their 16S rRNA amplified. The RNA that was amplified had been inoculated in 1 of 2 ways. One set of each sample was inoculated into TSB, left to incubate over-night, and then 75 μ l of this was lysed before PCR. The colonies of the other set were placed directly into 75 μ l of TE buffer and lysed before PCR. The purified products were sequenced using a SpectruMedix SCE 9610 automated glass capillary sequencer. Only the clones from sample E2 were sequenced, with 50 out of 96 identified. Most were halophilic Archaea. Amplicon lengths ranged from 442 – 794 bp, and had an average percent identity of 96.9%. Over 10 different genera were identified thus indicating a very diverse community existed in this saltern pond.

INVESTIGATION OF THE HALOPHAGE FROM THE GREAT SALT LAKE. Sarah Strom & Carol Litchfield, Dept. of Biol., George Mason Univ., Fairfax VA. 22030-4444. Halophage are viruses that attack halophiles, which are salt-loving bacteria. Depending on which halophile the halophage is specific to it can destroy a whole laboratory stock. So far scientists have only been able to isolate and study fifteen halophages. One of the topics that scientists have been trying to prove is that halophages are important in controlling the amount of halophiles that can occur in a natural environment. Another issue is the specificity of halophages in controlling the number of species that can inhabit a hypersaline environment. The Great Salt Lake is the largest terminal hypersaline lake in Northern America. This is where the halophages that will be studied will come from. The goal of this research is to isolate halophages and determine their specificity and their burst size. If possible, their DNA will be extracted, studied, and then compared with other known halophages as well. Given this information, science will be that much closer to understanding how halophiles and halophages bring a balance in nature.

COMPARATIVE ANALYSIS AMONG SUMMERS 2001, 2003 AND 2004 FOR TWO STREAMS IMPACTED BY COMMERCIAL DEVELOPMENT AND ROAD CONSTRUCTION. Michelle L. Arthur, Michael L. Bass, Timothy A. Jordan, E.B. Law, & R.H. Strickler, Dept. of Environ. Sci. & Geology, UMW, Fredericksburg VA 22401. Research assessed ecological damage on England Run and the Unnamed Tributary due to construction of the Celebrate Virginia North project of Stafford County. Summer data was gathered in 2001 prior to construction, and during construction in the 2003 and 2004. Benthic macroinvertebrate communities and water chemistry were sampled at seven sites on the streams. A modified EPA approved Rapid Bioassessment Protocol was used, focusing on species diversity and population count per species to estimate health of insect communities. In 2004, the Hilsenhoff Biotic Index improved at four of the stations but increased at the remaining three. Percent EPT improved at all stations. Trophic level distribution became increasingly unequal since 2001. Total insect and total organism populations decreased from 2001 but increased from 2003. Water chemistry analyzed D.O., temperature, pH, conductivity, fecal coliform, TSS, TDS, TOC, zinc, manganese,

copper, alkalinity, total hardness, nitrates and phosphates. All indicators were within a normal range except for dramatically higher sediment levels than in 2001 and 2003.

EFFECTS OF MICROTOPOGRAPHY ON VEGETATION AND SOIL NUTRIENTS IN A MITIGATION WETLAND IN VIRGINIA. Kurt Moser & Changwoo Ahn, Dept. of Env. Sci. & Policy, George Mason Univ., Fairfax VA 22030. In a created wetland in northern Virginia, microtopographic relief resulting from initial soil preparation by disking was examined in relation to macrophyte species richness and soil nutrient content. Microtopography was characterized for 8 sites using a microrelief index based on tortuosity, using data from 8m-diameter circular elevation transects. End-of-growing-season vegetation surveys for four of the first five post-construction years were used to assess species richness for each site, as well as relative abundance of naturally-induced versus seeded species. Plant species richness increased with microrelief index value, particularly with respect to naturally-induced species. Soil samples from microhigh positions were consistently higher in nutrients than were those from microlow (1.5% C and 0.085% N by weight on average versus 1.2% C and 0.057% N, respectively), even though the elevation differences were no more than roughly 20cm. Results suggest that enhanced soil disking after grading might reduce the necessity for seeding during wetland creation and that artificially-created microrelief affects soil nutrient distribution.

IMPROVING UNIVERSITY WASTE MANAGEMENT PRACTICES. Christopher A. Couture, Geography Department, Radford University, Radford, VA 24141. Following the campus sustainability audit, I began an in-depth review of the University's recycling efforts. For a number of reasons, on-campus recycling has become less and less attractive to the faculty, students, and staff of Radford University. With only slight fluctuations, the campus recycling rate has been steadily declining since a high mark of 29 percent in 1994. By 2003, RU was recycling only 6.4 percent of its solid waste stream. The purpose of this report is to determine the reasons for the steady decline in the campus recycling rate, through learning the history of the program, and analyzing the available recycling data. After describing some of the reasons for the declining rate, I outline some of the strategies that may be used in the near future to increase the overall campus recycling rate. The campus community should be leading the way when it comes to environmentally friendly activities, but we fall well below the 25 percent state mandate for recycling. Improving the campus recycling rate is an important step on the path towards sustainability, and creates a "waste wise" campus community, which should be a must in the 21st century.

SO YOU WANT TO DO A CAMPUS ENVIRONMENTAL AUDIT? Judy Guinan, Environmental Center and Richard Roth, Department of Geography, Radford University, Radford, VA 24142. A campus environmental audit performed at Radford University in Summer 2004 provided lessons about the audit process and strategies that can enhance its efficiency and likelihood of success. Our audit used student interns to collect data on energy use, water use, waste management, transportation, business ties, and environmental literacy of students. We focus here on the processes of defining the scope of the audit, planning the project, improving participation and "buy-in" by stakeholders, determining appropriate benchmarks for evaluation of the University's environmental performance, and developing recommendations to improve it.

AN ANALYSIS OF ENERGY CONSUMPTION AT RADFORD UNIVERSITY. Kevin T. Lillard & Judith A. Guinan, Radford University, Radford VA 24142. Universities are among the largest consumers of energy in the nation, and at the same time leading educators about environmental conservation. In this study, we analyzed Radford University's energy consumption and compared it with that of a university of comparable size with a noteworthy conservation record. Results show that RU's consumption of energy is higher than the energy

use of that institution. However, because RU uses environmentally-friendly natural gas as its primary source of fuel, our carbon dioxide production levels compare favorably with the energy efficient university.

A PRELIMINARY COMPARISON OF ECOTOXICOLOGICAL RATINGS FROM TRIBUTARIES IN THE NORTH FORK OF THE POWELL RIVER WATERSHED. Brandi S. Echols¹, Rebecca J. Currie² & Donald S. Cherry¹. ¹Department of Biology, Virginia Tech and ²Department of Biology, Roanoke College. A feasibility study was conducted in the Powell River watershed from 1995-2004. Ecological impairment was evaluated utilizing an Ecotoxicological Rating (ETR) system to assess the potential ecological impairment from Acid Mine Drainage (AMD). ETRs generated in these studies determined Ely Creek and Well's Branch sub-basins to be the most degraded due to AMD influences. Twenty sites were evaluated in the Ely Creek and 15 were given either a D (moderately stressed) or F (stressed) rating. Although fewer sites were studied in the Well's Branch sub-basin (four), 75% of sites were determined to be impaired. Based upon these ETR scores, the US Army Corps of Engineers began remediation efforts in the Ely Creek sub-basin. Construction of two passive wetland remediation systems was completed in October 2003. Current research has shown that remediation efforts have been successful with improved ETRs at sites below the wetland systems.

PRELIMINARY ASSESSMENT OF THE ASIATIC CLAM (*CORBICULA FLUMINEA*) AS A STANDARD TOXICITY TEST ORGANISM. Ryan D. Baxter, Rebecca J. Currie & Amy E. Alexander, Roanoke College Biology Dept, Salem VA. The use of invertebrate organisms to evaluate water quality is widespread. Benthic macroinvertebrate survey and acute and chronic toxicity testing rely upon commonly accepted species to indicate various levels of pollution. These species are easily cultured and widely researched with regards to chemical toxicity. The database that results from the continued evaluation of known toxicant stress is later applied to evaluate water quality in collected samples (as with discharge permits). The goal of this research is to provide an additional species (*Corbicula fluminea*) with which to consider water quality. The initial focus regards the laboratory culture of recently released pediveligers in an effort to effectively maintain pediveliger populations through maturity into umbral juveniles. A secondary goal of this research is to use the developing juveniles to establish LC50 values for comparison to currently used organisms.

WETLAND MITIGATION PROGRESS IN STORMWATER MANAGEMENT PONDS OF CENTRAL PARK, FREDERICKSBURG, VA AND AN OFF-SITE CONSTRUCTED WETLAND. Timothy A. Jordan, Michael L. Bass, Michelle L. Arthur & Catherine R. Otey, UMW Dept. of Environ. Sci. & Geology, Fredericksburg, VA 22401. As part of a wetland mitigation performance review required in permits issued by VDEQ and USACE for site work disturbance of wetland areas associated with the construction of a large business and commercial park, a woody stem count was completed in the summers of 2002, 2003 and 2004. Performed water tests focused primarily on D.O., conductivity, pH, temperature, nitrates, phosphates, total alkalinity, total hardness, copper, manganese and zinc. No spikes in water quality parameters were found in the stormwater management ponds. Within the off-site wetland, the area was gridded off to determine an estimated woody stem count. Within the gridded areas all woody stems were counted and compiled to establish the density per acre of the 2.07 acres of wetland. In 2003 the stem count yielded 557 trees per acre whereas in 2004 the count yielded 1096 trees per acre. The herbaceous identification yielded 17 more species than in the previous year. This increase in density signifies success according to VDEQ requirements.

Geography and Geology

CONFOUNDING CHARACTERISTICS OF THE NATIONAL LAND COVER DATA (NLCD: USGS) CLASSIFICATION SCHEME. A. Scott Bellows^{1,2}, & Thomas R. Allen², Jr., ¹Dept. of Biological Sciences & ²Dept. of Political Science and Geography, Old Dominion University, Norfolk, Virginia 23529. We intended to use the United States Geological Survey's (USGS) National Land Cover Dataset (NLCD) as an independent variable to model mosquito habitat in the City of Chesapeake, Virginia. Before doing so, we ran an accuracy assessment of the NLCD (Level II [*e.g.*, deciduous forest]: 12 classes) using 1,016 citywide points selected by a stratified-random design and verified using digital orthophotos (USGS). Overall accuracy (OA) of the NLCD data for Chesapeake was 29% ($K^{hat} = 0.28$)—accepted $K^{hat} \geq 0.8$. We ascribe these poor results to confounding attributes of the NLCD classification scheme; primarily to the lack of mutual exclusion between land cover and land use classes (*e.g.*, various forest types and light residential or natural and recreational grasses). We reclassified the data using a level I scheme and reran the accuracy assessment and achieved improved results (OA 76% ($K^{hat} = 0.66$)). In addition, the USGS classification and accuracy assessment of these data was conducted on a 5-state mid-Atlantic region with far more spatial variation than the City of Chesapeake. We suggest that a portion of the remaining error can be attributed to this added variation.

GAP ANALYSIS OF FRESHWATER FAUNAS AND PROTECTED AREAS IN GREECE. Eugene G. Maurakis^{1,2,3} & David V. Grimes¹, ¹Science Museum of Virginia, 2500 W. Broad St., Richmond, VA 24542, ²School of Continuing Studies, University of Richmond, VA 23173, and ³Department of Environmental Science and Policy, George Mason University, Fairfax, VA 22030. Objectives of this study are to compare the number and type of protected areas in Greece to the distributions of freshwater fishes listed as extinct (2 species), critically endangered (5), endangered (7), and vulnerable (13); and to evaluate if the current protected areas afford meaningful and long-term protection for the species and habitats. A total of 2,359 GIS distributional records of species in 32 drainages of Greece were compared to the 113 protected areas in Greece. Current aquatic areas are inadequate to protect threatened species as the percent of additional aquatic protected areas needed to protect species are 48% for vulnerable; endangered (65%); critically endangered (93%); and extinct (80%). We discuss the number, type, and location of protected aquatic areas needed to protect freshwater fish species and habitats, the need to map assemblages of aquatic species, and management of biotic entities for long-term conservation. Funded by the Thomas F. Jeffress and Kate Miller Jeffress Memorial Trust, Science Museum of Virginia, and University of Richmond.

THE I-81 CORRIDOR GEOLOGIC MAPPING PROJECT: AN OVERVIEW. Matthew J. Heller, Elizabeth V. Campbell, Scott T. Williams, Gerald P. Wilkes, Harry A. Hibbitts & Julia S. Reis, Virginia Department of Mines, Minerals and Energy, Charlottesville, VA. In 2004, the Virginia Department of Mines, Minerals and Energy, Division of Mineral Resources (VDMR) combined several existing geologic mapping projects in western Virginia into a single long-term mapping project along Interstate Highway 81. The goal of this project is to provide a detailed geologic map in a digital format for a ten-mile-wide corridor along the length of the entire interstate in Virginia. This mapping will be used to locate mineral and water resources, construct roads and other infrastructure, plan land use, and complete environmental assessments in this developing and ecologically important part of Virginia. Components of the project include digitizing and field checking existing paper maps, completing new mapping, and compiling individual digital maps into a Geographic Information System. Initial work has revealed that resolving "quadrangle boundary faults" and inconsistent mapping of large structures and stratigraphy requires significant fieldwork to resolve. The targeted completion date for this project is 2020. The project is cooperatively funded by the STATEMAP component of the USGS National Cooperative Geologic Mapping Program.

MAKING “I.T.” (INSTRUCTIONAL TECHNOLOGY) WORK: DEBUNKING COMMON MYTHS IN TEACHING AND LEARNING IN THE GEOSCIENCES. P. S. Sethi, Department of Geology, Radford University, Radford, VA 24142-6939. This paper addresses some of the common misconceptions concerning faculty and I.T.. The most important myth involves a faculty member ignoring educational psychology and models of learning for creating effective teaching modules involving I.T. Other myths include – thinking that 1) use of IT modules for teaching will result in a significant time-savings, 2) because most faculty have terminal degrees in their disciplines, they do not need the IT help that is readily available through IT support professionals on campus, 3) a teacher has to know all about everything within the sizeable realm of IT to create effective IT applications, 4) just because students are being taught via integration of IT outlets (such as CD-ROM, DVD-ROM, Flash animation, streaming video, Java applets on the internet) means that they are learning better, 5) my students are learning better because they say so; with anecdotal, qualitative data, 6) multiple backups and computer access strategies have finally allowed a teacher to not need the ‘older’ IT such as chalk, transparencies, slides, and 7) that a teacher does not need to ‘storyboard’ prior to composing IT modules. Solutions are provided to counter each of the aforementioned myths from the experiences of the author.

RELATIONSHIPS BETWEEN DEGREE OF PYRITIZATION AND MACRO- AND MICRO-SEDIMENTARY STRUCTURES IN ORGANIC-RICH, BLACK SHALES: A CASE STUDY OF THE DEVONIAN MILLBORO SHALE IN SOUTHWESTERN VIRGINIA. P. S. Sethi, Department of Geology, Radford University, Radford, VA 24142-6939. Black shales that accumulated in anoxic benthic conditions are typically enriched in organic carbon and polymetallic sulfide complexes (PMSCs) such as pyrite. Such pyrite is a contributor to Acidic Mine Drainage (AMD). A recent study by Combs & Sethi (2001) of the black Millboro Shale and the gray Needmore Shale in Highland County have revealed differences in the occurrence of pyrite on a macro scale. This study expands on the morphological differences of PMSCs in these two shales. The more anoxic Millboro Shale layers tend to contain larger (4-6 cm long) pods and blebs of PMSCs, likely representing accumulation and pyritization of localized, large-sized clumps of organic matter. Petrologic, SEM and EDAX microprobe analyses of the more oxic Needmore Shale, however, reveals much smaller frambooids of PMSCs but which are much more widely distributed within the shale. Oxidation of such gray shales can still pose a AMD threat because of the larger surface area associated with the smaller PMSC morphologies and post-formational fracturing associated with orogenic events as observed in this location.

Medical Science

STATUS EPILEPTICUS INDUCED INHIBITION OF NEURONAL ENDOPLASMIC RETICULUM CALCIUM SEQUESTRATION. L. S. Deshpande¹, N. S. Haider², R.J. DeLorenzo^{1, 2} & J.T.Parsons², Departments of Pharmacology and Toxicology¹, Neurology², Virginia Commonwealth University, Richmond, VA. Status epilepticus (SE) is a serious neurological disorder characterized by significant morbidity and mortality. Loss of calcium (Ca^{2+}) homeostasis is thought to be responsible for the selective vulnerability of hippocampus upon SE. Here we investigated the functionality of Ca^{2+} homeostatic enzyme endoplasmic reticulum (ER) $\text{Mg}^{2+}/\text{Ca}^{2+}$ ATPase in sequestering Ca^{2+} upon SE. Whole cell patch clamp recordings of neurons exposed to low Mg^{2+} for 3 hours demonstrated seizure like activity. Calcium uptake was significantly inhibited in these cultures. This inhibition was not due to increased neuronal death due to low Mg^{2+} . Further, neuronal cultures didn't demonstrate significant inhibition of Ca^{2+} uptake until 3 hours of exposure, the duration required for epileptogenesis in this model. Finally, Ca^{2+} microfluorimetry demonstrated that intracellular free Ca^{2+} was significantly elevated in neurons exposed to low Mg^{2+} for 1 and 3 hours. This study suggests that inhibition of ER $\text{Mg}^{2+}/\text{Ca}^{2+}$ ATPase contributes to the loss of neuronal Ca^{2+} homeostasis and increased vulnerability to hippocampal cell death.

HSP65 ANTIBODIES: RISK FACTOR FOR ATHEROSCLEROSIS DEVELOPMENT?. Elena Gianulis & Kathryn Loesser-Casey, Dept. of Biol., Univ. of Mary Washington, Fredericksburg VA 22407. Various pathogenic processes may be important in the development of atherosclerotic plaques. Plaques become a serious problem when they rupture leading to myocardial infarction or stroke. There are several known risk factors for disease development; emerging evidence suggests that high levels of heat shock proteins, in particular HSP65, may be a risk factor as well. Bacteria produce HSPs similar to human HSPs, leading to molecular mimicry in which autoimmune antibodies cross-react and bind to the human HSPs. In this research, the relationship between HSP65 antibody levels and known risk factors was studied. Health and lifestyle information, a family medical history, and blood samples were collected from 114 individuals. Total cholesterol, HDL, triglyceride, LDL and the HSP65 antibody levels were measured in the blood and statistical tests were run using SPSS to determine relationships. A significant relationship was found between HSP65 antibody levels and a family history of stroke and between HSP65 antibody levels and LDL if the individuals also had a family history of stroke. No relationship was found between HSP65 levels and LDL in individuals with no family history. This may be explained by differences in LDL particle size, as smaller, LDL particles are proatherogenic.

EFFECT OF CALCIUM SENSING RECEPTOR AND ERK ACTIVATION ON VITAMIN D RECEPTOR IN PROXIMAL KIDNEY CELLS (HK-2). Aparna Maiti & M. J. Beckman. Departments of Biochemistry and Orthopaedic Surgery, Virginia Commonwealth University, Richmond, VA 23298. Extracellular calcium (Ca^{2+}) is thought important for $1,25(\text{OH})_2\text{D}_3$ -receptor (VDR) expression in renal proximal tubules. Culture medium containing 3.2 mM of Ca^{2+} induced VDR protein with maximum induction at 6 h. Also, 3.2 mM of Ca^{2+} activated pERK within 5 min and remained elevated out to 30 min. EGF induced VDR content in HK-2 cells. These data indicate a link between CaSR and EGFR activation on renal proximal VDR regulation. (Supported by: Department of Orthopaedic Surgery, Jeffress Foundation, USDA-ARS, CRA and A.D. Williams Foundation.).

EFFECTS OF ULTRAVIOLET RADIATION IN SACCHAROMYCES CEREVISIAE USING MICROARRAY ANALYSIS. Consuelo J. Alvarez & David E. Walker, Dept. Of Nat. Sci., Longwood Univ., Farmville VA, 23909. The increasing number of skin cancer cases and the advent of microarray technology lead our interests to use a model genetic system to analyze the changes in gene expression when cells are exposed to ultraviolet radiation. Yeast cells, *Saccharomyces cerevisiae*, were exposed to UV radiation for ten seconds with the light source being held three inches away from the cell colony plate. After irradiation, cells were harvested at the log phase, and mRNA was extracted. A non-denaturing agarose gel confirmed the integrity of mRNA from both the control and the irradiated sample. The mRNA was converted to cDNA and labeled with Cy3 and Cy5 dyes. Labeled cDNA was then hybridized onto yeast microarray chips. The chips were scanned and results were analyzed by the computer program known as Magic Tool. Preliminary visual analysis indicates repression of and induction of certain genes. Strong induction was observed for GIC2 gene, which codes for a GTPase interacting component. Strong repression was observed for CBF5 gene which codes for a centromere / microtubule binding protein. A complete statistical analysis using the Significance Analysis of Microarray program (SAM) is currently being performed.

FUNCTIONAL REDISTRIBUTION OF CANNABINOID RECEPTORS ($\text{CB}_1\text{-R}$) IN THE RAT PILOCARPINE MODEL OF ACQUIRED EPILEPSY. Katherine W. Falenski¹, Robert E. Blair², Laura J. Sim-Selley¹, Billy R. Martin¹, & Robert J. DeLorenzo^{1,2}, Depts. Of Pharmacology/Toxicology¹ & Neurology², Virginia Commonwealth University, Richmond, VA. Recent studies have shown that the $\text{CB}_1\text{-R}$ is plastic in a rat epilepsy model as measured by significant long-term increases in region-specific hippocampal $\text{CB}_1\text{-R}$ protein expression. The

purpose of this study was to use agonist-stimulated [^{35}S]GTP S autoradiography to assess CB₁-R-mediated G-protein activation. WIN55,212-stimulated [^{35}S]GTP S binding was redistributed in epileptic rats, with increases in whole hippocampus and the stratum radiatum of CA3, and decreases in the dentate gyrus inner molecular layer. [^{35}S]GTP S binding changes were due to an increased E_{max} and were CB₁-R specific as demonstrated by CB₁-R antagonist reversal and similar changes produced with several CB₁-R agonists. This redistribution was unaffected by anticonvulsant administration. These results indicate that epilepsy causes long-term plasticity changes in functional CB₁-R G-protein activation. This CB₁-R plasticity during epilepsy may play a crucial role in cannabinoids' anticonvulsant nature and the role of the endocannabinoid system in epilepsy. Support: RO1-NS23350, P50-NS25630, DA07027, and DA14277

RENAL PROXIMAL VITAMIN D METABOLISM AND CELLULAR SIGNALING IN RESPONSE TO CHANGES IN CALCIUM AND VITAMIN D STATUS. Vallalan Natesan, Amandeep Bajwa, Joerg Schilcher and Matthew J. Beckman, Departments of Biochemistry and Orthopaedic Surgery, Virginia Commonwealth University, Richmond, VA 23298. This study examined for *in vivo* renal proximal cell signaling pathways involved in hypercalcemic (HC) and hypocalcemic (LC) conditions of renal cortex vitamin D metabolism. Using Affymetrix GeneChip[®] Microarray analysis, significant elevated gene expression patterns in the HC condition were noted for numerous receptor tyrosine kinase genes. In Contrast, significant differential changes in the CREB, GATA-1, CBP interacting protein, C/EBP revealed evidence of PKA dominated pathway in the LC condition. (Supported by: Department of Orthopaedic Surgery, Jeffress Foundation, USDA-ARS, CRA and A.D. Williams Foundation.).

THE EFFECTS OF TESTOSTERONE AND PPAR LIGAND, ROSIGLITAZONE, ON ADIPONECTIN, TNF- α , AND INSULIN RESISTANCE IN DIABETIC MICE. Renee L. Eldridge & Kathryn Loesser-Casey, Dept. of Biol., Univ. of Mary Washington, Fredericksburg VA 22407. Type 2 diabetes is characterized by insulin resistance. Two adipose-derived hormones, adiponectin and TNF- α , along with testosterone and Peroxisome Proliferator Activated Receptors (PPAR's) have been linked to insulin resistance. The goals for this research were to study the effect of rosiglitazone (a synthetic PPAR ligand) on insulin resistance, adiponectin and TNF- α levels in type 2 diabetic mice and to determine whether the presence of testosterone affected the activity of rosiglitazone. Type 2 diabetic, 9-week-old male mice were either castrated or sham-operated and fed chow with or without rosiglitazone (3 mg/ kg body weight) for 2 weeks. The mice were sacrificed and glucose, adiponectin and TNF- α levels were measured in their blood. Those mice fed rosiglitazone treated food had low levels of TNF- α (less than 0.03 ng/ml) and adiponectin was measurable only in the non-diabetic animals. The rosiglitazone-treated diabetic mice had relatively low non-fasting glucose levels indicating that glucose tolerance appeared improved by the treatments. Finally, castration did not seem to affect any of the levels.

Q/W, AN ANALOG OF 1,25-DIHYDROXYVITAMIN D₃: EFFECTS ON MESSENGER RNA STABILITY AND GENE EXPRESSION OF 25-HYDROXYVITAMIN D₃-24-HYDROXYLASE IN MKL-4 HUMAN BREAST CANCER CELLS. R. Oyesanya¹, A. Bajwa¹, E. Kim¹, C. Wong¹, C. Chakarun¹, S. Sundaram², and M.J. Beckman¹, ¹Dept. of Orthopaedic Surgery, Virginia Commonwealth University, Richmond, VA 23298 and ²Dept. Surgery, Dartmouth Medical School, Lebanon, NH. 1,25-dihydroxvitamin D has potent anti-proliferative, anti-invasive and apoptotic properties in many cancer cells. Its non-calcemic analog 1-hydroxymethyl-24-difluorovitamin D (Q/W) also demonstrates specific suppression of 24-hydroxylase (CYP24) transcript in MKL-4 breast cancer cells, by both GeneChip[®] Microarray

and RT-PCR analyses. Reduction of CYP24 could be beneficial to cancer prevention. However, in the present study, Q/W induced CYP24 promoter activation. This suggests the mechanism of CYP24 transcript decrease is by mRNA destabilization. (Supported by: Department of Orthopaedic Surgery).

IDENTIFICATION AND CHARACTERIZATION OF cKLF1, A NOVEL CHICKEN ERYTHROID SPECIFIC TRANSCRIPTION FACTOR. Andrew P. Chervenak¹, Priyadarshi Basu², Latasha C. Redmond² & Joyce A. Lloyd², Depts. of ¹Biology and ²Human Genetics, Virginia Commonwealth University. The Krüppel-like factors (KLFs) are a family of DNA binding proteins with a conserved C2/H2 zinc finger domain that are related to the *Drosophila* Krüppel gene. Currently, 16 KLFs have been identified in mammals and shown to regulate proliferation, apoptosis, and differentiation during development. KLF1/EKLF was the first of the KLFs to be identified in vertebrates and it binds to the CACCC box in the β -globin promoter, positively regulating β -globin expression during definitive erythropoiesis. In mice, KLF1^{-/-} embryos are anemic and die by E16. We have identified cKLF1, a homologue of EKLF/KLF1 in the chicken (*Gallus gallus*). The putative amino acid sequence of the zinc finger region of cKLF1 is 90.1% and 91.4% similar to murine and human KLF1, respectively. Using RT-PCR analyses, we determined that cKLF1 mRNA is highly enriched in blood cells compared to brain in chick embryos. cKLF1 expression increases 8- to 10-fold in definitive compared to primitive erythropoiesis during chicken development. This is significantly greater than the 2- to 3-fold increase seen during mouse erythroid development.

AN ANALYSIS OF MEDICAL CARE IN FOUR COUNTRIES. Donika Patel and J. Orion Rogers, Dept. of Biology, Radford University, Radford VA 24142. The objectives of this study were to examine the healthcare systems of the United States (US), Canada, Australia and the United Kingdom (UK) in terms of healthcare expenditure, financial structure, method of delivery and health achievement. Total healthcare expenditure as a proportion of gross domestic product in 2001 varied from 7.6% in the UK to 13.9% in the US. Canada, Australia and the UK provide universal healthcare, but only 86% of the US population is covered by insurance. Specialists are 70% of US physicians compared to 49% in Canada and 30% in Australia. Australia had the highest life expectancy in 2002, 82.6 years for females and 77.4 years for males compared to 79.9 for females and 74.5 years for males in the US. Average length of stay for acute care ranges from 7.1 days in Canada to 5.9 days in the US, while the percentage of patients waiting more than four months for elective surgery in 2001 averaged 5% in the US and 38% in the UK. A reformed healthcare structure for the US is proposed. The US should provide universal healthcare similar to the current system in Canada. Medicare and Medicaid should be dissolved, and their funds should be combined with taxes to create federal and state health department budgets to support public hospitals, physicians, dentists, optometrists and pharmaceuticals.

¹ ADRENERGIC RECEPTOR MEDIATED AORTIC CONTRACTILITY DIFFERS IN FEMALE AND MALE RATS BUT IS MASKED BY VASCULAR ENDOTHELIUM. Richard P. Wyeth¹ & Richard H. Kennedy², ¹Edward Via Virginia College of Osteopathic Medicine, Blacksburg, VA & ²Loyola University of Chicago, Stritch School of Medicine, Maywood, IL. Previously published results show adrenergic contractility in rat thoracic aorta demonstrates gender related differences. Our studies further investigate endothelium's role in male and female Sprague-Dawley rats. Thoracic aortas were placed in oxygenated Krebs-Henseleit buffer. Endothelium was removed from one of each paired preparation.. Aortas were constricted with serial increases of phenylephrine (Phe). Acetylcholine (Ach) dose response curves followed. A depression of α_1 AR response associated with intact aorta is seen in female preparations, but not in males. Potency shows no difference for any group. Maximum developed tension is greater in denuded female samples versus (vs) male. All denuded preparations lack Ach mediated vasorelaxation. Ach induced relaxation is not different in the male and female intact aortas. Our

results indicate that male aortic α_1 AR sensitivity is unaffected by endothelium while female aortas are endothelium sensitive. That is, in female Sprague-Dawley rats, α_1 AR mediated aortic contraction is greater than males but, in the presence of her endothelium, it is masked.

THE EFFECTS OF TLR4 STIMULATION ON CYTOKINE PRODUCTION AND ATHEROSCLEROSIS IN MICE. Elizabeth Williams, L.C. Beck & K.E. Loesser. Biology Dept, Univ. of Mary Washington, Fredericksburg, VA, 22401. Research has shown that atherosclerosis is related to the inflammatory response of the immune system. Individuals with mutations to the innate immune receptor, Toll-like receptor 4 (TLR4) have much lower rates of atherosclerotic plaque development. This research project seeks to understand the relation between TLR4 stimulation and atherosclerosis. Two TLR4 ligands, lipopolysaccharide (LPS) and lipoteichoic acid (LTA) were selected to be injected into TLR4 deficient and TLR4 normal mice. One ml of 100 μ g/ μ l LPS and LTA were injected three times a week to experimental groups of five mice apiece for 15 weeks. After 15 weeks, the mice were sacrificed and their hearts were removed. The heart tissue was used to make paraffin-embedded microscope slides and to isolate RNA for RT-PCR. The RT-PCR was not successful. The microscope slides indicated increased atherosclerotic development in response to LPS and LTA injections. A statistically significant difference between the controls and the LPS and the controls and the LTA in TLR4 –normal mice was observed. With further evidence, this data could support the position of Toll-like receptor 4 as a major player in atherosclerotic progression.

EVALUATION OF THE IMMUNOMODULATORY EFFECTS OF DIBENZ(A,H)ANTHRACENE IN ADULT FEMALE B6C3F1MICE. Denise M. Hernandez, Wimolnut Auttachoat, Tai L. Guo & Kimber L. White Jr., Department of Pharmacology & Toxicology, Virginia Commonwealth University, Richmond, VA 23298-0568. Dibenz(a,h)anthracene (DBA) is an environmental contaminant classified on EPA's priority pollutant list. It is a polycyclic aromatic hydrocarbon formed by the incomplete combustion of carbon-containing compounds. The objectives of these studies were to evaluate the immunomodulatory effects of DBA in adult female B6C3F1 mice. Mice were exposed subcutaneously to DBA in corn oil (158, 500, 1580, and 5000 g/kg) daily for 28 days. Several quantitative measures and functional assays, e.g. the IgM antibody forming cell (AFC) response to the T-dependent antigen, sheep red blood cells, natural killer cell (NK) activity, anti-CD3 antibody-mediated proliferation, mixed leukocyte response (MLR), delayed type hypersensitivity (DTH) response and phenotypic analysis, were employed to evaluate humoral, innate and cell-mediated immunity. The results of these studies indicate that DBA is a potent suppressor of a variety of immune functions at low exposure levels with the humoral immunity as the most sensitive. (Supported in part by the NIEHS Contract ES 05454).

Natural History and Biodiversity

LIFE-HISTORY CHARACTERISTICS OF THE ATLANTIC PIGTOE, *FUSCONAIA MASONI*. Jacob M. Rash, Dept. of Fisheries & Wildlife Sciences, Va. Polytechnic Inst. & State Univ., Blacksburg, VA 24061 & Dr. Richard J. Neves, U. S. Geological Survey and Dept. of Fisheries & Wildlife Sciences, Va. Polytechnic Inst. & State Univ., Blacksburg, VA 24061. In 2002, a tanker truck released approximately 21,198 L of emulsified asphalt into the Nottoway River, Virginia, which contains one of the best remaining populations of the Atlantic pigtoe, *Fusconaia masoni*. Thus, efforts were initiated to reduce potential impacts associated with the released asphalt. We sought to provide needed information on fecundity, host fish identification, and age and growth of the Atlantic pigtoe. Estimated number of mature glochidia per mussel ranged from 1,188 to 11,033. Ages of relic shells ranged from 7 to 34 yr, with a mean age of 13 yr. White shiner, *Luxilus albeolus*, and satinfish shiner, *Cyprinella analostana*, hosts produced 20

and 9 metamorphosed juveniles, respectively, with excystment occurring between 19 and 24 d following infestation. Juvenile survival to 3 wk was 9.4%, with individuals having an average length and width of 241.6 μm , and no juveniles survived to 6 wk. This study resulted in information that is paramount to the future recovery efforts of the Atlantic pigtoe.

A NEW SPECIES OF SILVERFISH (*INSECTA: NICOLETIIDAE*) FROM A MEXICAN CAVE. Adriana F. Fisher, Issa J. Rishmawi & Luis Espinasa, Arts and Sciences Dept., Shenandoah University, Winchester VA 22601. A new troglobitic Nicoletiidae species was described in this presentation. In 1979 cave explorers C. Soileau and P. Strickland found cave-adapted silverfish in "El Soatano Hondo del Pinalito" cave in Mexico. The specimens were deposited in the American Museum of Natural History, NY. Samples used by authors were found in a vial of ethanol alcohol at this location. After study of the material, it was determined that the samples belonged to an undescribed species. The following characteristics distinguish this species from others: Pedicellus of the male in this species are enlarged on the posterior side almost creating a lobe, four macrochaetae on the mandibles, and microscopic spines at the base of the male genitals. The parameres of the males and in the ovipositor of the females were also different from other described species. Research results have been submitted for publishing to the Proceedings of the Entomological Society of Washington.

ASSESSMENT OF SOME BIOLOGICAL AND CONSERVATION PARAMETERS IN A SMALL POPULATION OF SAGUAROS, CORONADO NATIONAL FOREST, AZ. Lyla H. Gray, Jayson J. Przybyla & Luis Espinasa, Department of Natural Sciences, Shenandoah University, Winchester, VA 22601. Landowners and neighbors are concerned about the preservation of a small population of the endangered Saguaro cactus, *Carnegiea gigantea* in the northern portion of the Coronado National Forest (CNF). The northern portion of the CNF has very few Saguaros, except for the ones found in this small population. A pilot study was developed to compare biological parameters between a healthy population in the Saguaro National Park West (SNPW) and the small northern population in CNF to determine if any differences existed that may indicate that the population is at risk. The northern CNF has a significant lower population density with the average distance between two cacti being 38.6 feet; while in SNPW is 17.5 feet. The northern CNF population also has a decreased number of young Saguaros when compared to SNPW. This reduction in new recruitment may modify future densities of the Saguaro population and may threaten its maintenance. Further studies need to be conducted to determine the cause of the declining population.

LONG-DISTANCE DISPERSAL MOVEMENTS OF BOG TURTLES. K.K. Fleming¹, C.A. Haas¹, S.L. Carter², & M. J. Pinder³, ¹Department of Fisheries & Wildlife Sciences, Virginia Tech, Blacksburg, VA 24061, ²Inventory & Monitoring, National Park Service, 4598 MacArthur Blvd., NW Washington, DC 20007, ³Virginia Department of Game and Inland Fisheries, 2206 S. Main Street, Blacksburg, VA 24060. Bog turtles (*Glyptemys muhlenbergii*) are rare and declining, and little is known about movements. We investigated dispersal of bog turtles in 6 wetlands in southwest Virginia to determine the frequency of movements among sites both connected by stream corridors and unconnected. Marked populations of bog turtles exist at these sites due to past capture and marking efforts from 1988 to the present. Out of 244 marked turtles, 11 had moved among sites; 4 to unconnected sites and 7 to connected sites. Of the turtles that moved between sites, 64% moved to connected sites although only 33% of the sites were connected by a stream corridor; however, this comparison is confounded by distance between sites because connected sites were closer together than unconnected sites. Our results suggest that bog turtles do make infrequent, long-distance movements between wetlands, and are able to disperse across upland habitats (i.e., do not always follow stream corridors). Partial funding or in-kind support was received from the Virginia Academy of Science, NPS, VDGIF, and VT.

A GRAPH THEORETIC ANALYSIS OF THE RELATIONSHIP BETWEEN GLOBAL LINGUAL STRUCTURES AND HUMAN GENETIC STRUCTURES. Timothy Yu, Dept. of Bio., Virginia Commonwealth Univ., Richmond VA 23284. Languages and genetics have had a hand to hand relationship throughout history. Many recorded instances throughout history explain of the variations we see today in both language and genetics; ranging from human migration to the major empires that have been in power. In this study, 52 populations of indigenous people were investigated for their genetic and lingual makeup. A genetic theoretic graph was constructed using 378 microsatellites and the populations were analyzed based on their covariation to one other. A lingual theoretic graph conservatively traced each population to their root family giving them a qualitative value and these populations were analyzed on their covariation to one another. Then a congruency theoretic graph was compiled to visualize the topological overlapping of genetics and languages. Our database also incorporated a scatter-plot of the distal differences between the populations. The matrix correlations were compiled using the Mantel statistic. The findings indicated that there is structural congruency between language and genetics topologies yet no relationship with distance, a finding resulting from our misunderstanding of early language lineages.

STATUS OF INTRODUCED *SARRACENIA PURPUREA* L. SITES IN MARYLAND AND VIRGINIA WITH COMMENTS ON PITCHER PLANT CONSERVATION. Philip Sheridan^{1&2} & Richard Duffield³, ¹Meadowview Bio. Research Station, ²Dept. of Biology, Old Dominion Univ., ³Dept. of Biology, Howard Univ. Inquiline communities (midge *Metriocnemus knabi*, mosquito *Wyeomyia smithii*, rotifer *Hybrotrocha ros*, mite *Sarraceniopus* sp.) were characterized for 21 natural and introduced populations of the purple pitcher plant, *Sarracenia purpurea*, in Maryland and Virginia. Nine of the sites were natural populations; five were initiated with transplanted plants and seven initiated with seed. The species-specific midge was absent from 6 of the introduced sites. The mosquito was absent from 6 introduced sites. These data indicate that *H. rosa* can colonize introduced populations in the absence of both the midge and mosquito. These data also suggest that the species-specific mite can invade introduced populations in the absence of the fly species. Several *S. purpurea* populations initiated with seed did not contain midges and did not show any evidence of the presence of other species of mosquitoes. The lack of midges and/or mosquitoes in several of the introduced sites indicates that the midge and probably the mosquito are not efficient at locating new pitcher plant populations to colonize. The authors support initiating *Sarracenia purpurea* populations with seed under regimented procedures in regions where pitcher plants are threatened due to site elimination.

THE EFFICACY OF VISUAL ENCOUNTER SURVEYS FOR POPULATION MONITORING OF *PLETHODON PUNCTATUS* (CAUDATA:PLETHODONTIDAE). William D. Flint & Reid N. Harris, Dept. of Biol., James Madison Univ., Harrisonburg VA 22807. We initiated a monitoring study of the endemic plethodontid salamander, *Plethodon punctatus*, which is generally found in talus habitats over 1000 m in elevation in a narrow range on Shenandoah Mountain on the border of Virginia and West Virginia. We tested the congruence of nighttime visual encounter surveys (VES) and mark-recapture estimates of population size. VES was a valid index of the abundances of *P. punctatus* in the two habitats we surveyed. Sites on the eastern and western sides of Shenandoah Mountain were surveyed, and both methods estimated that population size on the west was approximately twice as high as that on the east. Individuals of this species exhibited a high degree of site fidelity. Cover object searches for species in talus habitats are expected to be of limited value, and we conclude that nighttime visual encounter surveys are most effective for population size monitoring of *P. punctatus* and other species that live in talus. (Supported by: USDA Forest Service, West Virginia Division of Natural Resources, and the United States Geological Survey).

A NEW BIOPRESERVE IN VIRGINIA, THE JOSEPH PINES PRESERVE. Philip Sheridan^{1&2}, ¹Meadowview Biological Research Station, ²Dept. of Biology, Old Dominion University. Meadowview Biological Research Station is a non-profit 501(c)(3) organization dedicated to preserving and restoring Virginia's imperiled longleaf pine/pitcher plant ecosystem. Part of the organization's 10 year goal was to establish a preserve in southern Virginia to maintain the biodiversity of that ecosystem. That goal was realized with the purchase in 2004 of a 100 acre tract of land in Sussex County known as the Joseph Pines Preserve. The preserve currently maintains all known yellow pitcher plant populations as well as several that have been extirpated. An effort is also being made to capture the entire germplasm of Virginia longleaf pine as well as numerous other rare associate species which are being extirpated on private land. Several acres have already been restored to native longleaf pine. Restoration efforts are ongoing and include prescribed burns and chemical control of woody competitors. Educational outreach is also an important component of the preserve in order to educate citizens of the commonwealth about Virginia's natural heritage.

IDENTIFICATION OF SUITABLE HOST FISHES FOR THE ENDANGERED CUMBERLAND ELKTOE FRESHWATER MUSSEL (*Alasmidonta atropurpurea*) (Unionidae: Bivalvia). Jennifer A. Guyot & Richard J. Neves, U. S. Geological Survey, Dept. of Fisheries & Wildlife Sciences, Va Polytechnic Inst. & State Univ., Blacksburg, VA 24060. Freshwater mussels have a complex life cycle in which transformation from larval to juvenile stages requires parasitism on specific host fish. Anthropogenic changes in mussel habitat, including dam construction and water pollution, have caused a drastic decline in mussel abundance and diversity, resulting in 70 species listed as federally endangered or threatened in the U.S. The Cumberland elktoe (*A. atropurpurea*) was listed as endangered in 1997. It is endemic to the upper Cumberland River, and its range is limited to 12 known sites. Host fish identification trials were performed, using seven fish species representing 4 families. Active, pedal-feeding juveniles excysted on four species, the banded sculpin (*Cottus carolinae*), northern hogsucker (*Hypentelium nigricans*), redline darter (*Etheostoma rufilineatum*), and fantail darter (*E. flabellare*). Banded sculpins produced the most juveniles per fish and are considered to be the most suitable host fish for propagation of this species to achieve recovery.

STUMPED, THE CHALLENGE OF IDENTIFYING DENDROLITHS. Philip Sheridan^{1&2}, Thomas L. Eberhardt³, Jolie Mahfouz³, & Chi-Leung So³, ¹Meadowview Biological Research Station, ²Dept. of Biology, Old Dominion University, ³Southern Research Station USDA Forest Service. Old, resinous pine stumps with axe-cut turpentine boxes can be found in the forests of coastal Virginia. These stumps were presumably once longleaf pine trees since this species was almost exclusively used for the extraction of turpentine by the colonists. The discovery of turpentine stumps in central Virginia, outside the known range of longleaf pine, questioned the presumption that all turpentine stumps in Virginia were once longleaf pine trees. We used NIR spectra, PCA, GC/MS, and specific gravity to determine the taxa of the unknown stump samples. Wood anatomy was not used in the analysis since most southern pine taxa cannot be differentiated by wood morphology. While we were able to eliminate pond pine as a candidate species we could not determine the identity of the stump samples conclusively. Part of the identification problem is that there are no standards for comparing old pine samples of unknown origin to. The identification of these stump samples is important in assisting conservation biologists in properly restoring degraded ecosystems and phytogeographers in mapping the historical distribution of indigenous taxa. We coin the word "dendrolith" to describe old pine stumps which have been embalmed through the excessive production of turpentine for naval stores.

THE 2004 VIRGINIA SOCIETY OF ORNITHOLOGY BREEDING BIRD FORAY ON THE NORTHERN NECK OF VIRGINIA. Andrew S. Dolby¹ & Sandy Spencer², ¹Dept. of Biological Sciences, Univ. of Mary Washington, and ²Rappahannock River Valley National Wildlife Refuge. The 2004 Virginia Society of Ornithology Breeding Bird Foray was conducted June 5-13, on the Northern Neck of Virginia, a peninsula bounded by the Potomac and Rappahannock Rivers and the Chesapeake Bay. Twenty-two participants recorded bird species richness and abundance on 29 tracts averaging 300 ha in size and comprising both public and private land. Survey tracts ranged in location from northwestern King George Co. to far southeastern Lancaster Co. A total of 131 species were reported during the survey period, representing 15 orders and 43 families. Red-winged Blackbirds were most abundant, followed by Common Grackles and Red-eyed Vireos. For 13 species, only one individual each was reported. Indigo Buntings were found on the greatest number of survey sites, whereas approximately half of all species were detected in 10 or fewer locations. The Wilna tract of the Rappahannock River Valley National Wildlife Refuge, with 81 species, was the most species rich survey site. Previous breeding records in the Northern Neck region exist for all but nine of the total species reported. However, direct signs of breeding activity were observed for only 52 species, from sightings of male-female pairs to active nests containing viable nestlings. While active nests were seen for eighteen species, the greatest number of such reports was for Osprey. Similar species totals were reported during previous Northern Neck forays conducted in 1968 and 1993. However, some species turnover has occurred since then, and several species have declined in abundance. The Northern Neck's avian diversity ranks highly among other regions in the state and contains at least 37 species that appear on one or more conservation watch lists.

Poster Presentations

DETERMINING A SUITABLE SUBSTRATE SIZE AND SAMPLING FREQUENCY FOR REARING JUVENILE FRESHWATER MUSSELS (Bivalvia: Unionidae). Aaron J. Liberty & Richard J. Neves, Dept. of Fisheries and Wildlife Science, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. The effects of sampling frequency and substrate size on the growth and survival of juvenile rainbow mussels (*Villosa iris*) were investigated in 4 L round flow-through tanks. All tanks contained either fine sediment (<50 µm), fine limestone sand (500-850 µm), or coarse limestone sand (1000-2500 µm), and were sampled every 2 wk or once at the end of the 10 wk experiment. At 10 wk, tanks left unsampled had significantly higher overall survival ($P<0.05$) at 40.2%; 12.8 % better survival than tanks sampled every 2 wk. No significant differences in growth were present between sampled (825 µm) and unsampled tanks (855 µm). Coarse sand resulted in the best survival of juveniles at 36.6 % in sampled tanks, and fine sand had the best survival in unsampled tanks at 51.9 % at 10 wk. Results show that frequent sampling of juvenile *V. iris* may increase stress, and decrease overall survival and growth. It also appears that fine limestone sand, 500-800 µm in size, is the best substrate for juvenile culture purposes.

GROWTH OF CAPTIVE-BRED TARANTULAS, *PTERINOCHILUS MURINUS*, ON THREE DIFFERENT DIETS. Ryan S. Mays, Daniel P. Miller, & Charles M. Neal. Biology Department, RU. With growing interest in maintaining tarantulas in captivity, it is becoming increasingly important that the nutritional needs of tarantulas be investigated. The intent of this research was to investigate the effects of different protein diets on spider growth. Two groups of 17 juvenile captive-bred tarantulas, *Pterinochilus murinus*, were fed crickets maintained on commercially prepared cricket diets containing 12 % or 22% protein. Lettuce was also supplied as a source of moisture. A third group of 17 tarantulas was fed crickets maintained entirely on lettuce that contained less than 1% protein. Data was analyzed using ANOVA and Duncan's Multiple Range Test. After 4 and 7 months, the mean weights of tarantulas fed crickets maintained on either a 12% or 22% protein diet were significantly higher than the mean weight of tarantulas fed crickets maintained on a low protein diet. After 11 months on these diets, there was no

significant difference in body weights between the three groups. This research was supported by Radford University and Nutrition Support Services, Inc., Pembroke, Virginia.

Psychology

PSYCHOLOGICAL DISTRESS AS RELATED SOCIAL SUPPORT AMONG SINGLE MILITARY MOTHERS ENLISTED IN THE UNITED STATES NAVY. Michelle M. Tucker & Michelle Kelley, Dept. of Psyc., Old Dominion University, Norfolk, VA 23529. The purpose of this study was to examine how psychological distress relates to social support in single military mothers enlisted in the United States Navy. Participants included single active duty enlisted Navy mothers. They completed an online questionnaire that assessed their psychological distress as it relates to six constructs: stress, anxiety, depression, maternal guilt, separation anxiety and social support. Correlational analyses were conducted to assess the relationship between psychological distress and the hypothesized correlates. As hypothesized, individuals who reported greater levels of social support, less stress, and less maternal separation anxiety exhibited lower levels of psychological distress (i.e., depression, anxiety, maternal guilt). Deployment status could not be assessed in the current study.

GENDER DIFFERENCES IN SCORES OF EMOTIONAL INTELLIGENCE AND RECOGNIZING EMOTIONS FROM FACIAL EXPRESSIONS. Gozde Sahin & Elaine M. Justice, Dept. of Psyc., Old Dominion University, Norfolk, VA 23529. The interest of this study is to investigate the relationship between accurately recognizing emotions that people feel in certain situations and emotional intelligence scores in order to understand the importance of recognizing emotions for EI. The study will also investigate gender differences in emotional intelligence in two ways. Participants will be college students. First, the Schutte Self-Report Inventory of Emotional Intelligence will be given to participants. Second, the participants will be tested on a measure that uses story situations that reflect certain emotions. The first hypothesis will be that there will be a significant positive correlation between the Schutte Inventory and the Story Situations Measurement. Pearson R Correlation will be used to analyze this relationship. The second hypothesis will be that there will be differences in emotional intelligence between the two genders with females scoring higher overall on the Schutte Inventory. Results will be analyzed by performing an independent t-test.

AGE DIFFERENCES IN FUNCIONAL HEARING ABILITY DURING COMPLEX VISUAL-MOTOR TASKS. Katrina R. Lewis & Carryl L. Baldwin, Dept. of Psyc., Old Dominion University, Norfolk, VA 23529. A dual task paradigm involving different types of working memory tasks (a visual-spatial tracking task and a central executive decision making and planning task) were combined with a speech processing task presented at different presentation levels. Twenty-five young adults (18 and 35 years of age) voluntarily participated. As would be expected, dual task conditions involving the pairing of the central executive task and the speech processing task resulted in less time-sharing efficiency (decreased performance) than the combination of the visual spatial tracking task and the speech processing task. These results support the position that central executive resources are relatively independent of visual spatial resources. Future research will include a sample of older participants (60-85 year olds) to examine age differences using the dual task paradigm mentioned above.

HEMISPHERIC ASYMMETRY IN A FLIGHT SIMULATION TASK: VALIDATION OF SECONDARY TASKS. April R. Panganiban & Carryl Baldwin, Dept. of Psyc., Old Dominion University, Norfolk, VA 23529. The ability of two secondary tasks to draw upon separate processing resources by way of asymmetric activation of the hemispheres was investigated. The

two tasks differed only by instructions to either perform simple addition of serially presented numbers in the verbal task or to compare spatial locations of serially presented numbers in the spatial task. A dual-task paradigm with a primary flight simulation task was utilized. Performance data and recordings from scalp electroencephalogram (EEG) were collected from sixteen undergraduate participants (8 males and 8 female). Findings indicated differences in overall alpha power as primary task difficulty increased indicating increased task engagement and arousal. Results do not support significant differences between the two designed secondary tasks in resource processing.

THE EFFECT OF *PFIESTERIA* TOXIN ON RAT ACTIVITY IN THE ELEVATED-PLUS MAZE AND RESPONSE TO ETHANOL. Juan Constantine & Perry M. Duncan, Dept. of Psychology, Old Dominion University, Norfolk, VA 23529. Rats were injected with filtered water taken from aquaria tanks containing active cultures of *Pfiesteria Shumwayae*, a dinoflagellate which kills fish and causes cognitive dysfunction in rodents and humans. The anxiety level of these rats, and of controls not injected with toxic filtrate, was determined by their behavior in an elevated-plus maze test device. All rats were also injected with 600 mg/kg ethanol on some test days. Toxin-exposed rats exhibited greater anxiety as indicated by less time spent in open arms of the maze and fewer total arm entries under both ethanol and non-ethanol conditions. Ethanol treatment decreased anxiety in control animals, but not in toxin-exposed rats. These results demonstrate that exposure to *Pfiesteria* toxin causes anxiety in rats which is not relieved by ethanol.

AN INVESTIGATION OF CONTROL CONDITIONS IN ASCH-TYPE EXPERIMENTS: VI. Elisa M. Ramirez-Feliciano, Ahmad J. Bah, Tiffany Blake, Danial J. Kim, Sakeenah T. Abdullah, Rodolfo E. McIntyre, Adam J. Stinson, Shabiri Bhattacharyya & James P. O'Brien, Tidewater Cmnty. Coll., Virginia Beach VA, 23453. Reports additions to data from replications of Asch (1956) control conditions in a 2x2x2x2 protocol: 4-yr. vs. 2-yr. and male vs. female students with authoritative vs. peer and male vs. female Experimenters. Asch demonstrated stimulus clarity, a requisite feature of the "Asch dilemma," among his 4-yr. male undergraduate control participants: 94.6% of Ss were error-free, mean error = .08, and % error trials = .7%. With 15 of 16 cells completed, the respective measures for 305 men are 80.7%, .34, and 2.81%. The respective measures for 368 women are 73.1%, .52, and 4.33%. We conclude that Asch's stimuli do not constitute "an utterly clear perceptual fact" for most male conditions and for all female conditions, as most subsequent investigators have assumed. In fact, the only cell (n = 37) that approximates Asch's standards for stimulus clarity is the direct replication of Asch. Therefore, scores of replications of Asch's experimental conditions over the past half century; and, in fact, those data in Asch's (1956) Experiment 1 which were acquired by authoritative female Experimenters, must be reevaluated.

TEACHING KIDS TO CARE ABOUT WATER CONSERVATION. Nancy A. Margand & Priscilla W. Powell, Dept. of Psychology, Washington & Lee University, Lexington VA 24450. The role of participant interaction on the effects of environmental education programs was investigated in this study. An adaptation of the CATES-PV assessment was used to measure water conservation behaviors of 28 preschool-aged children. Over the course of 1 month, the children participated in 1 of 2 environmental interventions: either a series of 3 interactive activities or 3 short stories covering the same information. Finally, the CATES-PV adaptation was used to determine any changes in the children's water use behavior. Contrary to our expectation, children showed significant improvement in both the book and activity conditions, although older children showed a greater behavioral effect in the book condition. Therefore, the success of an environmental intervention is not contingent upon the level of participant interaction. However, a significant difference between the post-test scores of 4- and 5-year olds indicates that the effectiveness of certain techniques may vary between preschool-aged children.

Additional research on the relationship of behaviors and attitude is needed to clarify the value of these programs.

Statistics

NONPARAMETRIC APPROACHES TO RESPONSE SURFACE METHODOLOGY. Stephanie M. Pickle¹, Jeffrey B. Birch¹ & Timothy J. Robinson², ¹Department of Statistics, Virginia Polytechnic Institute & State University, Blacksburg VA 24061-0439 and ²Department of Statistics, University of Wyoming, Laramie WY 82071. Industrial statisticians, engineers and other researchers often employ the techniques of response surface methodology (RSM), a sequential experimental strategy originally proposed by Box and Wilson (1951). Historically, RSM involves running a series of small experiments and modeling the data parametrically to find the operating conditions for the design variables that will optimize the response(s). In many industrial settings, however, parametric models may not adequately represent the true relationships between the variables. For this reason, Vining and Bohn (1998) first propose the use of nonparametric smoothing in a RSM setting. While their work is innovative, several improvements and extensions can be made to it. We propose the use of methods that extend the ideas of classic RSM to include new advances in regression and optimization, such as local polynomial regression, model robust regression and genetic algorithms. These proposed methods will offer greater flexibility, robustness and efficiency. Furthermore, they may provide a better understanding of the process being studied as well as superior optimization solutions.

TESTING EQUALITY OF INTRACLASST CORRELATION COEFFICIENTS. Amal Helu & Dayanand N. Naik, Dept. of Math. & Stat., Old Dominion Univ., Norfolk VA 23529. Sib-sib or intraclass correlation coefficient is an important measure in the study of familial correlations. We consider the problem of testing equality of two sib-sib correlation coefficients when the family sizes are unequal. Using simulated data from multivariate normal distribution we evaluate the performance of three likelihood based tests, namely, the likelihood ratio test, Wald's test, and Rao's score test and two other asymptotic tests based on Srivastava's combined estimator of intraclass correlation. Performances of the score test and one of the asymptotic tests are found to be superior in most situations. However, none of these tests perform well when the data are from other multivariate distributions, for example, from multivariate t or a Kotz type distribution. We suggest using score test based on Kotz type distribution whose performance is robust under normal and non-normal distributions.

ON TESTING INDEPENDENCE BETWEEN CATEGORICAL VARIABLES WITH MULTIPLE RESPONSE. Yueqin Zhao & Dayanand N. Naik, Dept. of Math. & Stat., Old Dominion Univ., Norfolk VA 23529. Multiple response categorical variables, which summarize "choose all that apply" type of responses, are common in survey data. We consider the problem of testing independence between two such categorical variables based on analysis of diversity using Rao's quadratic entropy. In this talk, a brief review of analysis of diversity will be provided first. Then we provide various distances for computing Rao's quadratic entropy. We propose several alternative methods based on bootstrap for testing the independence of the two multiple response variables. Using bootstrap simulation we show that one of the proposed methods does well in terms of significance level and the power of the test.

YOUNG ENOUGH/TOO OLD GEST'L AGES, SAFE HAVENS, AND THE REINVENTION OF NATION'S THORNIEST DEBATE. Kevin Moran, M.S.P.H., Vertical Studies Group, Sterling VA 20164. Both health care and the law are sympathetic to the resolve of women, on the one hand, to ensure a "safe harbor" for themselves that relies on abortion to curtail harsh pregnancies, and, on the other hand, to ensure a "safe harbor" among pregnancies that precludes

abortion from specific cases. As if the horns of dilemma A were not enough, the abortion debate offers B: On the one hand, no single profile of abortion decision-makers exists; they span wide latitudes of demographics, lifestyles, economics, and political engagements. Some are open to abortion across diverse conditions, while others proscribe it (even opposite the camp expected!). On the other hand, the public sphere voices its conventional wisdom that the debate's whole complexion hinges on "young enough" gestational ages vs "too old," as Platt's research shows. Even authorities attuned to gestational age data will infer a pro-choice rule of law from the "youngest" pregnancies and a pro-life rule of law from the "oldest," arguing that one must cross camps at some intermediate gestational age. The two dilemmas suggest the intractability of any conceptual framework that could make sense of and to all camps. Au contraire, I introduce a novel conceptual framework, an instrument that follows, and appropriate statistical measures.